73 Amateur Radio Today

MAY 1994
ISSUE #404
USA $2.95
CAN $3.95
A WGI Publication
International Edition

The Truth About Electromagnetic Radiation

Is Amateur Radio Killing Us?

Speech Compression

Build A Super Audio Filter

73 Reviews

ICOM IC-2iA Micro HT and IC-737 HF XCVR

Special Advertising Insert from Radio City, Inc.

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(2 M mobile transceiver with 440 MHz receive!)

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* Optional UT-66 required.

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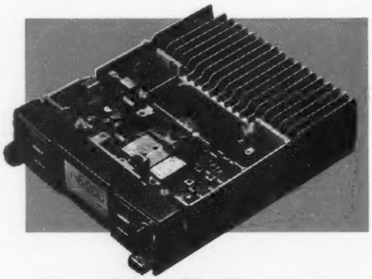

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BUSY
29
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IC-281H 144 MHz
FM Transceiver

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AUTO TRIGGER & HOLD - 2.8 GHZ COUNTER
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B	*TA-90*	Telescope BNC antenna	12.
C	*TA-90-L*	Telescope elbow antenna	16.
D	*RD-150*	150 MHZ rubber duck	16.
E	*RD-2750*	27-50 MHZ rubber duck	28.
F	*RD-800*	800 MHZ rubber duck	29.
G	*M-207-IC*	Interface cable for MFJ-207	10.
H	*P-110*	200 MHZ, 1x, 10x probe	39.
J	*LP-22*	Lo-Pass, audio usage probe	25.
K	*DC-10*	Direct, 50 OHM probe	20.

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CIRCLE 247 ON READER SERVICE CARD

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7 QRM SUPPRESSION • Other interference rejection features include Passband Shift (PBS), dual noise blanker, 3-step RF attenuation, IF notch filter, selectable AGC and all-mode squelch.

8 NOTCH TRACKING • Once tuned, the IF notch filter will track the offending heterodyne (±10 Khz) if the VFO frequency is changed.

9 DDS PHASE LOCK LOOP SYSTEM • A single-crystal Direct Digital Synthesis system is utilized for very low phase noise.

10 CW FEATURES • Full break-in operation, variable CW pitch. built in electronic keyer up to 60 wpm.

11 DUAL VFOs • Two separate VFOs for split-frequency operation. Memory registers store most recent VFO frequency, mode, bandwidth and other important parameters for each band.

12 200 MEMORIES • Memory capacity of 200 channels, each of which store frequency, mode, AGC and bandwidth.

13 COMPUTER INTERFACE • Built-in RS-232C interface for advanced computer applications.

14 ERGONOMIC LAYOUT • Front panel features easy to read color LCD display and thoughtful placement of controls for ease of operation.

15 HEAVY-DUTY POWER SUPPLY • Built-in switching power supply with Power Factor Correction (PFC) and "silent" cooling system designed for continuous transmission at maximum output.

"This device has not been approved by the Federal Communications Commission. This device is not, and may not be, offered for sale or lease, or sold or leased until the approval of the FCC has been obtained."

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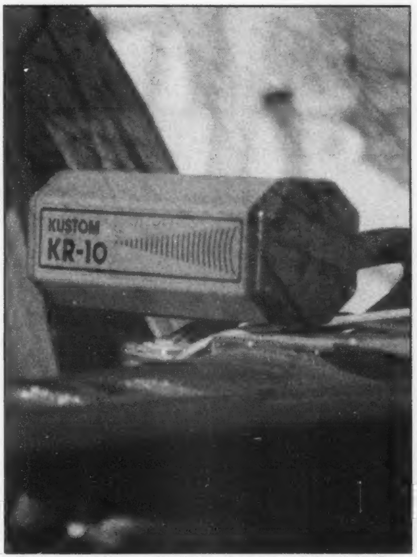

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On the cover: Senior Editor Charlie Warrington WA1RZW demonstrates how close we sometimes are to electromagnetic radiation. Turn to page 30 to learn more. (Photo by David Cassidy N1GPH.)

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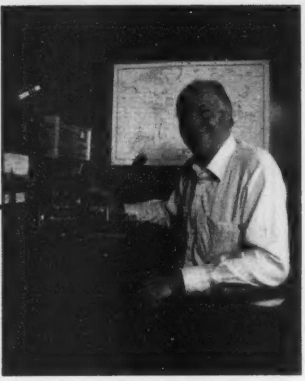
NEVER SAY DIE

Wayne Green W2NSD/1



Wayne at Dayton . . . Not!

The Hamvention chairman helped me make my decision . . . to not attend Dayton this year. I gather that Kenwood or someone more important wanted my traditional Saturday afternoon speaking slot, so they offered me Sunday morning. That's a fine spot, except that my experience has been that at that time I tend to outnumber the audience. The few hams who haven't already started on their drive home are either at church or are busy trying for one last two-dollar discount on a new rig from desperate dealers. It's really lonely on Sunday at Dayton.

There's always a bright side to things. In this case this will give me time to attend (and address) a Learning Technologies conference at New Brunswick Community College, which is the same weekend. They're working on distance learning projects, which I happen to think are the key to getting both the Canadian and American educational systems off the destructive track they've been on. It's easier to provide a whole new teaching system than to change the present one. And, obviously, the financial rewards are almost beyond calculation. There is a built-up need for quality education that will take years to satisfy.

Distance learning? That's via satellite, TV, cable, or videotape. And it can be made fairly interactive. We have over 250 million people in America who need to learn things which could be taught via videotapes. With some small language modifications these will also be good saleable products in Europe for another 400 or so million customers. In the long run this will be an inexpensive way to provide a superb educational product.

A course that will be used by millions of people can cost millions to make and be a bargain. This means we'll eventually be seeing educational videos which feature top performance talent, lots of graphics, and are fun to use. Maybe even exciting. Heck, they might even be more entertaining than some of the stupid sitcoms we have been wasting our lives seeing. Will they be able to compete with basketball games? Probably not.

I'll be sorry to miss saying hello to my thousands of friends at Dayton. I always enjoy that. And while the *73* booth didn't pay for itself in sales, I did enjoy the opportunity it provided for readers to find me and tell me how they don't always agree with my editorials. To which I should not just nod, but should tell 'em that if they don't agree with me, then they should do their homework and then they probably will. I don't shoot from the hip when I'm writing my editorials. I do my homework before I write.

I'll miss those big Hamvention barbecue sandwiches too. Mmm, they're good! What I won't miss for a minute are the crowds which make it almost impossible to get around the narrow aisles. And I won't miss having to stand in line for 10 minutes to say hello to someone in a booth. Or having to park a mile from the arena and walk through the mud to get there . . . and back. Or what seems like the inevitable rain, which further packs 'em into the inside exhibits.

On the bright side, I've been stewing (and writing) about how hamfests haven't changed hardly at all since I attended my first in 1938. Well, I've got what seems to me like a great solution on how to change hamfests so they'll be more fun and help attract new hams. If anyone cares much I'll explain what I have in mind. I think we'll be able to double or quadruple attendance, and at least triple the exhibitors. But hey, if I can think of something like that, why can't you? Give it a try and see what you can come up with.

Hamfests should be growing in popularity, not dying off. I've been disappointed to see one hamfest after another become unprofitable for us to have a booth, and then eventually blow away. I hear the Miami hamfest is a shadow of its old self, but then there hasn't been an original idea there within my memory. The failure of the recent *CQ Magazine* commercial hamfest series tells us it's time for a change. We should have big hamfests every year or two in our major cities. I believe we can, but only if we re-invent them.

Update

Now I see that TNT is going to broadcast a film on Amelia Earhart. Well, they haven't contacted me, and as far as I know, I'm probably the only person alive who really knows the inside story of her last trip. Frankly, I'm disappointed in you. I've written about this and you haven't passed the word. So I watched the recent TV program about Amelia blunder around, and ditto the author of the recent Earhart book. Tsk. Yes, she was a spy for the Navy, and I knew it before she made her trip.

Things have been moving fast in the cold fusion department. The University of Siena, Italy, recently demonstrated a nickel-hydrogen system which generated lots of power and kept on doing it for weeks after all input was removed. It didn't stop by itself, they had to stop it. This is particularly interesting in that the reaction has been at relatively high temperatures (around 500°F), so it's a more efficient system. The estimates I've seen are on the order of 300 kilowatts from three grams of nickel. The university has not been forthcoming on their system for initiating the reaction, but from the pictures my editor took it doesn't look very complicated. This is obviously not a chemical reaction.

Cold fusion presents a wonderful opportunity for experimenters. First, it doesn't cost a bundle to experiment in the field. Second, it doesn't take a Ph.D. in chemistry or physics, or anything else, for that matter. This is a whole new field and there are no experts yet. You could be one, if you wanted. Third, all of the research in this field so far has been empirical, which means everyone involved is trying this and that, and seeing what works and what doesn't.

Pons and Fleischmann got started with this because they'd run across an anomaly that seemed worth checking out when palladium and deuterium were put in a lithium bath. It was much the same with an outfit in Georgia that has been manufacturing steam heating systems that use a new approach to water compression to heat the water. Then their customers started remarking on how efficient their systems were, so they tested one and found it was more than 100% efficient. Hey, what's going on here?

What fields have you become an expert in? For that matter, what have you done with your life that has contributed even a little bit to the advancement of our society? One of the things that really disappointed me when I started going to the reunions of my old submarine buddies from WWII was that few of them had ever done anything of any significance since our time on the submarine. Indeed, that was the most important thing many of them had ever done.

It just isn't that difficult to become an expert in some field. In almost any field. When the microcomputer came along in 1975 I decided I'd have to learn how these darned things work. I went out and bought a stack of books on computer theory and started reading. When I found them difficult to understand (they were terrible . . . college texts), that gave me the idea to start *Byte*. I knew there would be thousands of people in the same fix.

No one knows yet how cold fusion actually works, so anyone new to the field is starting out fresh. Actually, a newcomer has an advantage. One of the things that has hurt cold fusion has been the know-nothing scientists who, because they don't have an explanation for what's happening, have been refusing to believe it. Their position is that every one of the research labs that has claimed positive results has made serious errors. It can't happen. It hasn't happened. Everyone is mistaken. One scientist and one journalist have staked their reputations on this with books they've published.

Amateurs have a great advantage in that they aren't limited by what they know, only by what they don't know.

So the next time you start reading about digital voice, digital data compression, video compression, or a crypto algorithm, don't blonk out your eyes like that stupid old orphan and her even older dog, put on your pioneer hat and head for the hills of learning. How's that for some creative clichés? Blonk that metaphor!

Custom Callsigns

As I've mentioned in a past editorial, I'm enthusiastic about custom callsigns. I thought this was a fine way for the FCC to make some money to offset what we're costing them. So I'm delighted they're now thinking in terms of making 'em available. They're great for club stations, for special events, and for serious ego cases. Like me.

Yes, of course I have a special call in mind. While on the one hand I'll hate to lose my old W2NSD call after all these years, on the other it would be nice to have a really distinctive call.

When I moved to New Hampshire from New York in 1962 I asked the FCC if I could get W1NSD, which had been unoccupied for several years. When I moved to North Carolina in 1948 to take an announcing job at WEEB in Southern Pines, the manager said I would also have to have a broadcast engineer's license. So I took the train to Washington that night and took the license test the next morning. And passed. While I was

Continued on page 90

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FL-62S Dual-Band 146/446MHz w/Fold-Over, No Ground Plane Required

Gain & Wave:	VSWR:	Max Power:	Length:	Connector:
146MHz 3.5dBi ½ wave 446MHz 6.0dBi ⅝ wave x 2	1.5:1 or less	150 watts	3' 5"	Gold Plated PL-259

NEW!

SB-7/SB-7NMO Dual-Band 146/446MHz w/Fold-Over, No Ground Plane Required

Gain & Wave:	VSWR:	Max Power:	Length:	Connector:
146MHz 4.5dBi ⅝ wave center-loaded 446MHz 7.2dBi ⅝ wave x 3	1.5:1 or less	70W FM	4' 7"	PL-259 or NMO style

NEW!

SB-5/SB-5NMO Dual-Band 146/446MHz w/Fold-Over, No Ground Plane Required

Gain & Wave:	VSWR:	Max Power:	Length:	Connector:
146MHz 3.0dBi ½ wave 446MHz 5.5dBi ⅝ wave x 2	1.5:1 or less	120W FM	38"	PL-259 or NMO style

NEW!

SB-2/SB-2NMO Dual-Band 146/446MHz

Gain & Wave:	VSWR:	Max Power:	Length:	Connector:
146MHz 2.15dBi ¼ wave 446MHz 3.8dBi ⅝ wave	1.5:1 or less	60W FM	18"	PL-259 or NMO style

B-10/B-10NMO Dual-Band 146/446MHz, Cellular Look-a-like

Gain & Wave:	VSWR:	Max Power:	Length:	Connector:
146MHz 0dBi ¼ wave 446MHz 2.15dBi ½ wave	1.5:1 or less	50W FM	12"	PL-259 or NMO style

B-20/B-20NMO Dual-Band 146/446MHz, Cellular Appearance, No Ground Plane Required

Gain & Wave:	VSWR:	Max Power:	Length:	Connector:
146MHz 2.15dBi ½ wave 446MHz 5.0dBi ⅝ wave x2	1.5:1 or less	50 watts	30"	PL-259 or NMO style

NEW!

SB-25/SB-25NMO Mono-Band 146MHz w/Fold-Over, No Ground Plane Required

Gain & Wave:	VSWR:	Max Power:	Length:	Connector:
146MHz 4.1dBi ⅝ wave center loaded	1.5:1 or less	100W FM	4' 9"	PL-259 or NMO style

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HM-P2K/F
Mini spkr/mic featuring full TX/RX quality!

Light weight, extremely small: 1'x2" with collar pocket clip.

HM-P2K: Kenwood Version
HM-P2F: Icom/Yaesu Standard/Alinco/etc.

TRI-BAND MOBILE ANTENNAS

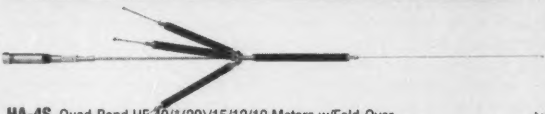
CX-224/224NMO Tri-Band 146/220/446MHz, w/Fold-Over, No Ground Plane Required

Gain & Wave:	VSWR:	Max Power:	Length:	Connector:
146MHz 2.15dBi ½ wave 220MHz 3.6dBi ⅝ wave 446MHz 6.0dBi ⅝ wave x 2	1.5:1 or less	100 watts	3'	PL-259 or NMO style

FJ-15S Tri-Band 52/146/446MHz w/Fold-Over

Gain & Wave:	VSWR:	Max Power:	Length:	Connector:
52MHz 2.15dBi ¼ wave 146MHz 4.5dBi ⅝ wave 446MHz 7.2dBi ⅝ wave x 3	1.5:1 or less	120 W FM	4' 10"	PL-259

HF MOBILE AND HT ANTENNAS



HA-4S Quad-Band HF 40/*(20)/15/12/10 Meters w/Fold-Over

NEW!

Wave:	VSWR:	Weight:	Length:	Max Power:	Connector:
¼ wave	2:1 or less	1 lb. 14 oz.	4' 4"	120W SSB (200W SSB 28MHz)	PL-259

*L-14HS Optional 20 Meter Coil

SH-55 Super Flexible 146/446MHz HT Antenna

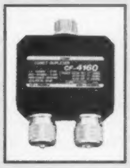
Gain & Wave:	Max Power:	Length:	Connector:
146MHz 1.5dBi ¼ wave 446MHz 3.2dBi ⅝ wave x 2	10 watts	15.5"	BNC

NEW!

CH-722SA High Gain HT Antenna
Gain & Wave: 146MHz 3.0dBi ½ wave
446MHz 5.5dBi ⅝ wave x 2
Max Power: 50 watts
Length: 35", 2 sections, 18" each
Connector: BNC

CH-32 Miracle Baby 146/446MHz HT Antenna
Gain & Wave: 0dB ¼ wave
Max Power: 10 watts
Length: 1.75"
Connector: BNC

DUPLEXERS AND MOBILE MOUNTS



CF-4106K, I, J,
146/446MHz
Band Pass, Ins Loss, Max Pwr.
1.3-150MHz, 0.1dB, 800w PEP
400-540MHz, 0.2dB, 500w PEP
Isolation: 60dB
CONNECTORS:

	4160K	4160I	4160J
Output:	SO-239	SO-239	SO-239
Low In:	PL-259	PL-259	SO-239
High In:	PL-259	N-Male	SO-239

RS-21
Trunk, hatchback, rear door (van, blazer, etc.) mount. Adjustable to virtually ANY angle. Rubber-coated base protects vehicle paint.

NEW!

RS-820
Heavy-Duty, Low Profile Trunk Lip or Hatch Back Mount. Rubber-coated base protects vehicle paint.

WS-1M
Multi-Adjustable Window Clip Mount.
11.5 feet of high quality coax. Gold-plated UHF Conns. for Antennas up to 40" in height.

NEW!

3D4M Standard Cable Assembly
13.5 feet of low loss coax. Gold plated UHF (PL-259/SO-239) connectors.

3D5M Standard Cable Assembly
Same as 3D4M, but 17 feet of coax

CK-5M Deluxe Cable Assembly
13 feet double shielded very low loss coax + 12" RG-188 teflon coax. Gold plated UHF (PL-259/SO-239) connectors.

CK-5M5 Deluxe Cable Assembly
Same as CK-5M, but 17 feet of coax

LETTERS

Number 2 on your Feedback card

From The Hamshack

Ward Stewart VE3FGS, Lakeland FL Wayne, I've been reading your rantings in the December 1993 issue of *73*. I have a couple of very quick reports for you.

I bought an Alinco DJ580 HT. I believe that it represents the best value around, and has the usual overabundance of bells and whistles. The receiver audio is really good and is sufficient to drive a commercial mobile speaker. Cutting a jumper gives DC to daylight frequency coverage. Selectivity is as good as can be expected with that kind of bandwidth.

My principal gripe is the smallness of the push-buttons and the readout. The manufacturers seem to forget that most of the hams with the bread to buy this type of equipment have reached the age where bigger is better. Perhaps I'm off base on this one.

The company has an excellent attitude with regard to customer service. They're always willing to listen.

So, you think you're abnormal. When did you reach that conclusion? You make it sound like a burden . . . it's not, and you know it. You can say and do all kinds of weird things and get away with it. It's wonderful to be thought of as abnormal, it's like a license to be free! The downside is that you're seldom taken seriously, with the resulting frustration of knowing that your views are valid, but lack validation by the mob. Console yourself with the knowledge that you at least have a pulpit!

P.S. Anyone with a limited budget who is considering buying a VHF mobile rig should consider this: Spend five or 10 bucks on a good (i.e. Motorola or GE) mobile speaker, and buy an HT instead of a mobile. 200 mW of audio into a good speaker is more than enough for most applications, plus you have the versatility of a mobile plus an HT. Two watts RF output is quite adequate for most repeaters, as you know. Need better coverage? Put your money into a gain antenna.

Dave Buren N2GE, Hancock NH Wayne, I find the issues discussed in the February 1994 "NSD" column immensely more interesting than the usual warmed-over ham radio techie topics. I picked up R. Becker's *Cross Currents* and it is truly fascinating. I especially appreciate your interesting reading references.

Count my vote to print the schematics for the microamp generator and magnetic pulser. This is exciting stuff . . . sure beats "ARRL Happenings."

Dennis Washer N4EXB/5V7WD, Jacksonville FL Wayne, in following your comments and other articles dealing with the effects of EM fields, I have found it interesting that the medical community is just now starting to wake up to the very real effects of this menace.

I have had the privilege of being reared in Western Africa (Niger). Having been born there and having spent 18 of my childhood years in colonial Africa, I can rarely recall having Africans at the dispensary/hospital with any form of cancer. Some of this may be attributed to a better present-day knowledge of what cancer looks like, but part of this low incidence is also due to a better diet (witness the low incidence of heart problems). More importantly, I believe that the lack of electricity of any form (and its associated power lines, transmitters, etc.) has played a vital role in this. The '70s and '80s brought modernization (rightfully needed), but with it came the generators, transmitters and power lines into even the humblest of mud huts. Is it coincidence that the incidence of cancers of all types has gone up?

I believe that future research will prove the damage brought about by electricity. But we cannot turn the clock backward and keep everyone in the "savage" years, and so our task as amateurs is to help protect that newly-emerging modern society by continuing our research into ways to safeguard against EM fields. We cannot just roll over and play dead and admit defeat; we must continue to be on the cutting edge!

Thanks, Wayne, for continuing to challenge us with your good magazine.

Camilo Carrau HI3CAZ, Puerto Plata, Dominican Republic I have followed your extraordinary journey through this puzzling and yet wonderful world of ours and sincerely, Mr. Green, let me use this opportunity to congratulate you, thanking God to have at least one Wayne Green incarnate!

I own and direct a small three-year-old television station on the north coast of the Dominican Republic: UHF21 Puerto Plata Television, licensed HICC. In our recent visit to our capital, Santo Domingo, my brother and I purchased the February issue of *73 Amateur Radio Today*. My brother, a physician and director of a rural hospital in our province, and I couldn't wait to return home to write you. Uncle Wayne, we *need* the circuit diagrams of *all* the units you have written about, both the anti-HIV and the other for the cure of drug addiction. Thus, I have decided to use the most expeditious and the Third World's safest way to contact you: the fax.

Please regard this letter as the answer not of a thousand but of millions of souls dwelling amidst ignorance and oblivion on this beautiful island shared with a nation bearing one of the world's highest indexes of AIDS: Haiti.

Rod Hogg K0EQH, Scott City KS Uncle Wayne, there have been many times I have been in agreement with your editorials, and quite a few times I've wanted to bang the table and strongly disagree, but that's history now. As of now, in reading the "Never Say Die" column in the March issue, I have been taken in by your comments on the "light" topic.

Interestingly or not, and you may be aware of it, in the February/March issue of *Modern Maturity* there is an article in the "Medicine" column on the use of light therapy for jet lag, etc., maladies by Stephen Rae. You may not be a member of the AARP (knowing how young you act) and thus you may want to locate a copy and add it to your info file.

As I read your column, I thought of my personal experiences with light, in particular sunlight, and the therapeutic effect it has on me. I recalled a meeting of a Kiwanis club I used to belong to. We had a member, a Dr. Goodwin, who was an optometrist who presented in our monthly program schedule an interesting motion picture (not a video, but a *movie*) on the studies made with light. I think it was the work done by John Ott. It dealt with slow-motion photography and his experiments with various lighting. Then Dr. Goodwin branched off on this with his work with light and learning disorders, in particular with the use of corrective lenses, etc.

What I wonder is, are the bad guys, ones with dark glasses all the time, just bad and getting "badder" because they never get any sunlight on the retina? Seems like all the hoods of the world are afraid of sunlight. Hmmm . . .

Best 73s. I will look for more "inspirational and moving" words of wit and wisdom.

Rod—Thanks for the fax. Yep, I get Modern Maturity. *Yep, I read the article.*

You'll want to read the Liberman book on light, too. Dr. Wm. Campbell Douglass also has a book, Into The Light. *It's $27 ppd. from Second Opinion, Box 467939, Atlanta GA 30346. You'll want to read the Ott book,* Health and Light, *too. Excellent. Cheers . . . Wayne*

Lyman H. Wolfla II K9LZJ, Boise ID Wayne, I have been reading your journal for a number of years now and have tried to at least skim your "Never Say Die" editorials. In the last few months it seems that you have finally moved from rehashing the same old ham radio issues to some new and exciting areas.

Last month I purchased the book *Cross Currents* and dug out my very old copy of *The Secret Life of Plants*. For the past 24 years my career has been in the application of business and technology in the world of medicine. Dr. Becker's book has renewed my interest in neuroanatomy and in the effects of both electrical and magnetic fields on the human body. Thank you for bringing this book to my attention.

As a clinical engineer I have long known the effects of light on the human body. I have always found that the natural sunlight coming in the window of my office/ham shack is important in starting my morning. Likewise, I do not use sunglasses unless I am flying or exposed to highly reflective light when skiing or sailing. Keep up the good work in helping our amateur population understand the effects of broad spectrum light.

Finally, I am most interested in learning more about your research into cold fusion. I plan to pick up the book *Fire From Ice* this week. Hopefully we will hear more from you regarding this exciting new field.

Like you I am getting rather upset with the "pleasure seeking" attitude of the American public. The advances in information and knowledge do not seem to be improving the government, or the direction in which it is going. The increase in crime, the generally poor quality of our school systems, and the continued growth of the welfare state is becoming more and more of a concern. Your editorials are refreshing in these areas. Keep up the good work!

James Devlin N5OQV, Newalla OK Wayne, while reading your editorial in the March 1994 issue I ran across one section, with the heading "Politics," that I had to comment on.

Trying to get people to do anything about the way things are going in *our* government is next to impossible. I sit there at work and listen to everyone complain about everything from taxes to crime. Try telling them to write or organize and try to do something about it and all you hear is "Well, it won't do any good," or "I don't have time." So I tried running off some letters on my computer thinking maybe they'd at least mail them to their representatives, but that didn't work either. I guess they don't want to spend the 29-cent postage.

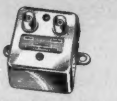
I joined the United We Stand group right at first. I mailed in my dues, got two petitions to sign and last month I got my renewal notice telling me how much good they were doing. Needless to say, I've still got my dues.

Anyway, I just wanted to say I definitely agree with your statement, "When we refuse to try and do something to solve our problems then we are condoning them." I don't know what the solution is but the people had better start doing something besides complain or the country of our grandchildren will not be anything like what it has been to our parents.

Low Cost GaAsFET PREAMPS

LNG-(*)

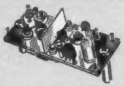
ONLY $59



FEATURES:

- **Very low noise:** 0.7dB vhf, 0.8dB uhf
- **High gain:** 13-20dB, depends on freq
- **Wide dynamic range** - resist overload
- **Stable:** low-feedback dual-gate FET

**Specify tuning range: 26-30, 46-56, 137-152, 152-172, 210-230, 400-470, 800-960 MHz.*



LNW-(*) MINIATURE PREAMP

ONLY *$29* kit, *$44* wired&tested

- GaAs FET Preamp similar to LNG, except designed for **low cost & small size.** Only 5/8"W x 1-5/8"L x 3/4"H. Easily mounts in many radios.

**Specify tuning range: 25-35, 35-55, 55-90, 90-120, 120-150, 150-200, 200-270, 400-500 MHz.*

LNS-(*) IN-LINE PREAMP

***ONLY $89* kit, *$119* wired&tested**

- GaAs FET Preamp with features similar to LNG series, except **automatically switches out of line during transmit.** Use with base or mobile transceivers up to 25W. Tower mounting brackets incl.

**Tuning range: 120-175, 200-240, or 400-500.*

HELICAL RESONATOR PREAMPS

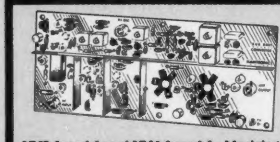
- GaAs FET preamps with 3 or 4 section helical resonators **reduce intermod & cross-band interference** in critical applications. **MODEL HRG-(*), *$80 vhf, $110 uhf.*** **Specify tuning range: 142-150, 150-162, 162-174, 213-233, 420-470.*

RECEIVING CONVERTERS

Low noise converters to receive vhf and uhf bands on a 10M receiver.

- **Kit less case *$49*, kit w/case & BNC jacks *$74*, w&t in case *$99*.**
- Input ranges avail: 50-52, 136-138, 144-146, 145-147, 146-148, 220-222, 222-224 MHz, 432-434, 435-437, 435.5-437.5, and 439.25 (to chan 3).

TRANSMITTING CONVERTERS



XV2 for vhf and XV4 for uhf. Models to convert 10M ssb, cw, fm, etc. to 2M, 220, 222, 432, 435, and atv. 1W output. ***Kit only $89.*** PA's up to 45W available.

KIT SALE

SPECIAL PRICES, FOR A LIMITED TIME, TO ENCOURAGE EVERY HAM TO BUILD AT LEAST SOME OF HIS EQUIPMENT; NOT ONLY FOR THE SATISFACTION, BUT BECAUSE IT IS EDUCATIONAL AND FUN! AND IT IS EASY WITH OUR THOROUGH MANUALS AND GREAT TECHNICAL SUPPORT.

VHF & UHF EXCITERS:

TA51 2W Exciter Kit for 6M, 2M, or 220 ....~~$109~~ **$89**

TA451 2W FM Exciter Kit for 440 MHz ....~~$109~~ **$89**

VHF & UHF RECEIVERS:

R144 2M FM Receiver Kit ...~~$149~~ **$139**

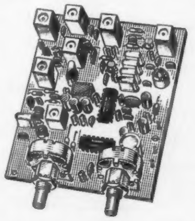
R220 220 MHz Rcvr Kit.......~~$149~~ **$139**

R451 UHF FM Receiver Kit .~~$149~~ **$129**

R901 900 MHz Receiver Kit .~~$169~~ **$139**

R76 FM Receiver Kit for 10M, 6M, 73 MHz, 2M, 220 MHz ....~~$129~~ **$89**

R137 Weather Satellite Receiver Kit for Weather Fax ....~~$129~~ **$89**



NEW

R76-M Monitor Receiver Kit for 10M, 6M, 73 MHz, 2M, hi-band, 220 MHz. Great for monitoring repeaters, amateur calling frequencies, or packet radio frequencies, and for listening to commercial two-way radio or police/fire frequencies. It makes a good starting kit to build, too, because it is easy to assemble and align. .... **only $59!**

DATA:

MO-202 FSK Data Modulator & DE-202 FSK Demodulator..................... ~~$49~~ **$39**

MO-96 9600-Baud Modem ...... ~~$49~~ **$39**

REPEATER INTERFACE:

COR-3 Repeater Controller ... ~~$49~~ **$39**

CWID Kit .... ~~$59~~ **$44**

COR-4 Controller/ID'er........... ~~$99~~ **$79**

TD-3 CTCSS (Subaudible Tone) Decoder/Encoder .... ~~$29~~ **$24**

DVR-1 Digital Voice Recorder ~~$89~~ **$59**

TD-2 DTMF Controller .... ~~$89~~ **$79**

AP-3 Autopatch...................... ~~$89~~ **$69**

NEW

COR-6 COR & Real-Voice ID on one board. Records up to 20 seconds of your voice.................... **only $99**

TD-4 Selective Calling Module and Economy DTMF Controller ..... **only $49**

Simplex Autopatch System with AP-2 Timing Board, AP-3 Autopatch, & TD-2 DTMF Controller .... ~~$217~~ **$177**

REP-200 REPEATER

A fully microprocessor-controlled repeater with autopatch and many versatile dtmf control features at less than you might pay for a bare-bones repeater or controller alone!

We don't skimp on rf modules, either! Check the features on R144 Receiver below, for instance: GaAs FET front-end, helical resonators, sharp crystal filters, hysteresis squelch.

Kit $1095; w&t only $1295!

(900MHz units slightly higher)

hamtronics
REP-200 REPEATER

- Available for the 50-54, 143-174, 213-233, 420-475, 902-928 MHz bands.
- **FCC type accepted** for commercial service (150 & 450).
- Power out 20W 50-54MHz; 25W 143-174MHz; 15W 213-233 MHz; 10W uhf; 10W 902-928MHz.
- Available add-on PA's **up to 100W.**
- **Six courtesy beep types**, including two pleasant multi-tone bursts.
- **Open or closed access autopatch, toll-call restrict**, auto-disconnect.
- **Reverse Autopatch,** two types.
- **DTMF CONTROL:** over 45 functions can be controlled by 4-digit dtmf command, via radio or telephone.
- **Owner can inhibit** autopatch or repeater, enable either open or closed access for repeater or autopatch, and enable toll calls, reverse patch, kerchunk filter, site alarm, aux rcvr.
- Cw speed and tone, beep delay, tail timer, and courtesy beep type **can be changed at any time** by owner password protected dtmf commands.
- **Auxiliary receiver input** for control or **cross linking repeaters.**
- Color coded **LED's indicate status** of all major functions.
- 3½ inch aluminum rack panel, finished in eggshell white and black.

NEW

REP-200T Voice Message Repeater. As above, except includes Digital Voice Recorder. Allows message up to 20 sec. to be **remotely recorded off the air** and played back at user request by DTMF command, or as a periodical voice id, or both. ..... **kit $1145, w&t only $1395**

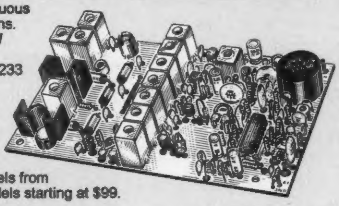
NEW

REP-200C Economy Repeater. Like REP-200, except uses COR-6 Controller (no DTMF control or autopatch). Features **real-voice id** recorded with built-in microphone. .... **Kit only $795, w&t $1095**

REP-200N Repeater. Want to use your ACC controller, etc.? No problem! We'll make you a repeater with rf modules only. .... **Kit only $695, w&t $995**

XMTRS & RCVRS FOR REPEATERS, AUDIO & DIGITAL LINKS, TELEMETRY, ETC.

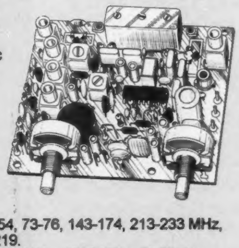
Also available in rf-tight enclosures, and with data modems.



FM EXCITERS: 2W continuous duty. TCXO & xtal oven options. ***FCC type accepted for com'l high band & uhf.***

- **TA51**: 50-54, 143-174, 213-233 MHz ...kit $109, w&t $189.
- **TA451**: 420-475 MHz ...kit $109, w&t $189.
- **TA901**: 902-928 MHz, (0.5W out); w&t $219.
- **VHF & UHF AMPLIFIERS.**
- For fm, ssb, atv. Output levels from 10W to 100W. Several models starting at $99.

FM RECEIVERS:



- **R144/R220 FM RECEIVERS** for 143-174 or 213-233 MHz. **GaAs FET** front end, 0.15uV sensitivity! Both crystal & ceramic if filters plus **helical resonator** front end for exceptional selectivity: >100dB at ±12kHz (best available anywhere!) Flutter-proof hysteresis squelch; afc tracks drift. ...kit $149, w&t $219.
- **R451 FM RCVR,** for 420-475 MHz. Similar to above. ...kit $149, w&t $219.
- **R901 FM RCVR,** for 902-928MHz. Triple-conversion, GaAs FET front end. ...$169, w&t $249.
- **R76 ECONOMY FM RCVR** for 28-30, 50-54, 73-76, 143-174, 213-233 MHz, w/o helical res or afc. ...Kits $129, w&t $219.
- **R137 WEATHER SATELLITE RCVR** for 137 MHz. Kit $129, w&t $219.

- Buy at low, factory-direct net prices and save!
- For complete info, call or write for free catalog.
  Send $2 for overseas air mail.
- Order by mail, fax, or phone (9-12 AM, 1-5 PM eastern time.)
- Min. $5 S&H charge for first pound plus add'l weight & insurance.
- Use VISA, Mastercard, check, or UPS C.O.D.

Our 32nd Year!

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65-D MOUL RD. — HILTON NY 14468-9535
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QRX . . .

Number 3 on your Feedback card

AMSAT 3-D Video

The Radio Amateur Satellite Corporation (AMSAT) has launched a publicity effort to ensure adequate funding for completing ham radio's newest, largest, most complex, and most expensive satellite ever. The nonprofit group recently enlisted the help of retired Senator Barry Goldwater K7UGA (see photo below) in producing an AMSAT 3-D informational video.

The one-quarter scale 3-D model seen in the photo was handmade by Stan Wood WA4NFY and appears in the video presentation. The production is narrated by former NBC Science Correspondent Roy Neal.

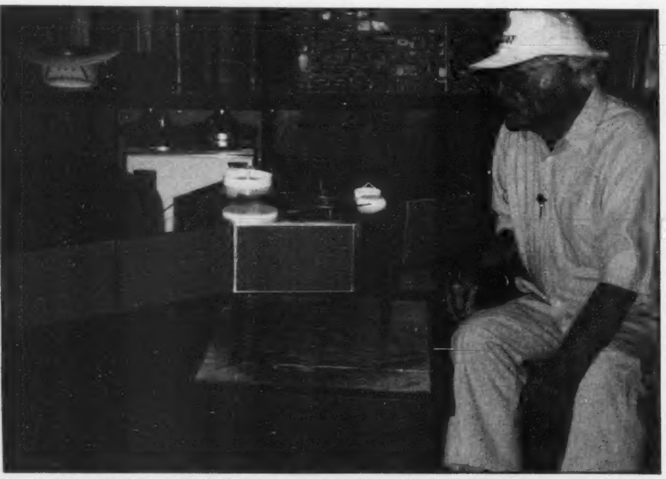
The new Phase 3-D video may be borrowed at no charge by sending a self-addressed 7-1/4" x 11" bubble-cushioned mailer and $2.90 US postage to AMSAT-NA, PO Box 27, Washington, DC 20044. It may be just the thing to liven up your next club meeting. Borrowers are encouraged to make their own copies of this video to help promote the project, which is due to be launched in 1996. *TNX Keith Baker KB1SF, V.P. for Strategic Planning, AMSAT.*

Keep Off My Machine

The FCC has issued a letter of interpretation that validates the authority of repeater system licensees to ban duly licensed radio amateurs from operating over their open repeaters. The letter comes in response to a request for clarification sought by Attorney Sidney Radus N6OMS of Orange, California. Radus is representing the Claremont Amateur Repeater Association (CLARA) in its fight to regain control over the way its club repeater systems are used and by whom.

The Commission's Personal Radio Branch Chief John B. Johnston W3BE clarified Section 97.205(e), which states ". . . Limiting the use of a repeater to only certain user stations is permissible." Johnston wrote, "The rule section applies whether a repeater is coordinated as an 'open' or 'closed' repeater. Further, the rule applies without regard as to whether a repeater is coordinated at all. Rule 97.205(e), without qualification, permits the individual responsible for proper operation of a repeater to limit the use of a repeater to certain user stations."

A man described as a "disgruntled former member" of the CLARA ham radio club was ordered by a civil court to stay off that organization's repeaters or face incarceration. The three-year restraining order is said to be an unprecedented action. *TNX Westlink Report, No. 667, February 28, 1994.*



Senator Barry Goldwater K7UGA (Retired, R-Arizona) looking over WA4NFY's model of the AMSAT Phase 3-D project at his Scottsdale ham shack. (AMSAT-NA photo by Keith Baker KB1SF.)

Getting Warmer

Superconductor research at computer giant IBM has reached a new temperature milestone. But, scientists are still a long way from creating room temperature superconductors.

Superconductors may someday revolutionize electronics and electrical power distribution systems. The goal is to create practical "perfect" conductors—materials having no resistance. Experimental prototypes have only worked in extremely cold environments until now.

Officials at IBM say they have created the first thin films of the mercury-barium-calcium-copper-oxide high temperature superconductor (HTS) that have zero resistance. Previous HTS demonstrations have needed bulk material or used thin films but exhibited some resistance. *TNX Electronic Engineering Times, Issue 788, March 14, 1994.*

Space is Limited

At one time or another, you probably have been advised to "Buy land, 'cause they ain't makin' any more." Well that same wisdom applies to radio spectrum and hams are lucky to have such a big chunk.

That notion was a key part of the remarks delivered by FCC Private Radio Bureau Chief Ralph Haller N4RH at the recent Tropical Hamboree in Miami. Haller said, "You are fortunate that there are many advances in technology that have helped to improve spectrum efficiency or else we might literally be out of spectrum today." Haller said the new Special Mobile Radio (SMR) band will be up to 40 times as efficient as today's analog FM technology. *TNX Westlink Report, No. 667, February 28, 1994.*

A Nickel for Your Thoughts

Reading minds via computer remains firmly in the realm of science fiction, but it may not seem so far-fetched anymore. Several years of improving athletes' performance using neurofeedback techniques has given Richard Patton special insight into brain-wave pattern analysis using desktop computers. Patton's new company, Advanced Neurotechnologies Inc. (ANI), is leveraging that expertise in a radically new approach to neurofeedback training.

By combining Motorola 56000-based DSP hardware with special DOS-based BrainLink software designed to capture and analyze electro-encephalogram (EEG) patterns, ANI has created a breakthrough brain wave-to-computer interface. The possible implications of this new technology are profound.

With BrainLink software, users can generate alpha, theta, and 40 Hz arousal states to initiate commands in much the same manner as they would use a speech-recognition system to input voice commands. Thus, you may soon be able to operate a wide variety of electronically controlled devices by merely using your head. *TNX Electronic Engineering Times, Issue 786, February 28, 1994.*

TNX . . .

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HI-PER Audio Filter

This project provides HIgh-PERformance CW filtering.

by David Cripe KC3ZQ

I've been watching with interest the proliferation of new audio filters utilizing Digital Signal Processing which have appeared lately on the ham radio market. Even though I'm all in favor of progress, I would really prefer to see products that the average ham could build for himself if he had the parts, or troubleshoot and fix if he had to. DSP can, without a doubt, provide some incredible improvements in performance of audio filters. However, not too many home-brewers have DSP chips laying about in their junk boxes, whereas a lot of us might have an LM324 or two. I contend there is still a lot of life left in the simple, lowly op amp!

I set out to design an active CW filter that would knock the socks off of any previously-published active filter design: one that could give a DSP design a run for its money; one that Joe Ham could build in a weekend and would cost less than a new set of finals for an FT-101.

Why mess with another active CW filter project? Well, the subject of CW filters is one in which the final page has yet to be written. Better CW filtering is one thing most hams wish for. For example, one of the more popular ham projects to come along in recent years has been the direct-conversion QRP rig. These rigs have the advantage of being simple, inexpensive, and easy to build. However, the direct conversion receiver cannot distinguish between upper and lower sidebands, so QRM can be a problem. The addition of good, sharp CW bandpass filtering to the direct-conversion receiver goes a long way to improving the usability of the rig, making it more practical for use in high-QRM situations.

Many commercial rigs suffer from poor CW filter designs which are either too broad, or suffer from excessive ringing. A good audio CW filter would be useful in these cases, as well. Many of the early SSB rigs had only a single-sideband IF filter, and no CW filtering. Finding a crystal CW filter for these antiques is by now nearly impossible. One example would be my old Heathkit HW-100, whose lack of a CW filter further motivated me to design my own!

Most active CW filter designs published so far have been really simple, utilizing one or two op-amp sections. If the bandwidth of these filters is made as narrow as that of a good CW crystal filter, they suffer from ringing, which tends to smear the transitions between the CW pulses and the spaces separating them, affecting the intelligibility of the CW characters. In order to achieve the maximum performance from the receiver, we must design a filter which has both a narrow bandwidth and minimal ringing.

In setting out to design the best active CW filter, I had to first discover the characteristics that made a good bandpass filter. While researching the subject of bandpass filters for CW reception, I discovered that there was far more to filter design than just throwing R's, C's and op amps at the problem. Apparently, the ringing one experiences in a poorly-designed CW filter comes from the phase response the filter possesses, rather than its amplitude response. Within the passband of the filter, the filter's phase shift versus frequency must possess a constant slope for the filter not to ring. The all-important slope of phase shift versus frequency is referred to as "group delay." A filter designer concerned only with designing a CW filter with a narrow amplitude response is likely to miss the requirement of constant group delay, ending up with a filter design that rings like a church bell. However, I found that a family of bandpass filters possessing the required flat group delay had been discovered by Blinchikoff [1]. These filters are optimized to possess minimal overshoot and ringing, and are ideal for this application.

Even with flat group delay, a minimum filter bandwidth is required for intelligibility of the code characters. Even though the information contained in 20-word-per-minute CW is concentrated mainly in a 25 Hertz bandwidth, without the addition of frequencies contained further away from the carrier, the CW signal sounds mushy and the characters are hard to distinguish. But, as one widens the CW filter to improve signal intelligibility, we increase its susceptibility to interference from close-by QRM. For this design, I chose a 200 Hz bandwidth as a compromise.

Figure 1 shows the filter topology and values of a passive version of this filter, 200 Hz wide, centered at 700 Hz. I have modified Blinchikoff's original design, adding a notch to the response at about 1600 Hz to sharpen the high-side QRM rejection of the filter, while leaving the filter's group delay essentially untouched.

Figure 2 shows the schematic of an active implementation of this filter. It uses its op amps in a configuration known as a "Generalized Immittance Converter" [2], (GIC), which allows the creation of active networks which simulate inductors, capacitors, etc. Unlike other active filter topologies, such as the Sallen-Key, with the GIC it is easy to make the conversion between a passive and active filter design. The schematic may seem complicated, but with careful layout and construction the circuit may be fabricated onto a few square inches of PC board which can be mounted inside most rigs, or outboarded in a separate box. The design here uses 12 op amps, which are contained in three 14-pin ICs. Despite the number of ICs, it won't blow the power budget of most QRPers, as the filter circuit consumes only about 10 milliamps. Although designed to run from 12 volts, the filter circuit will also work well from a 9 volt battery. The circuit does not require a split supply; the circuit containing op amps U1d and U3b provides a bias voltage in the middle of the supply voltage.

The filter circuit uses 1% tolerance resistors, as well as 0.022 µF capacitors, which must be fairly closely matched; 5% or better tolerance is preferred. These parts are available through sources such as Digi-Key or Mouser. The circuit can be assembled on a Radio Shack solder-pad perf board #276-168A or, better yet, on the custom PC board shown in Figure 3.

I have included a filter bypass relay K1, which can be used to switch out the CW filter when the operator wishes to return to SSB opera-

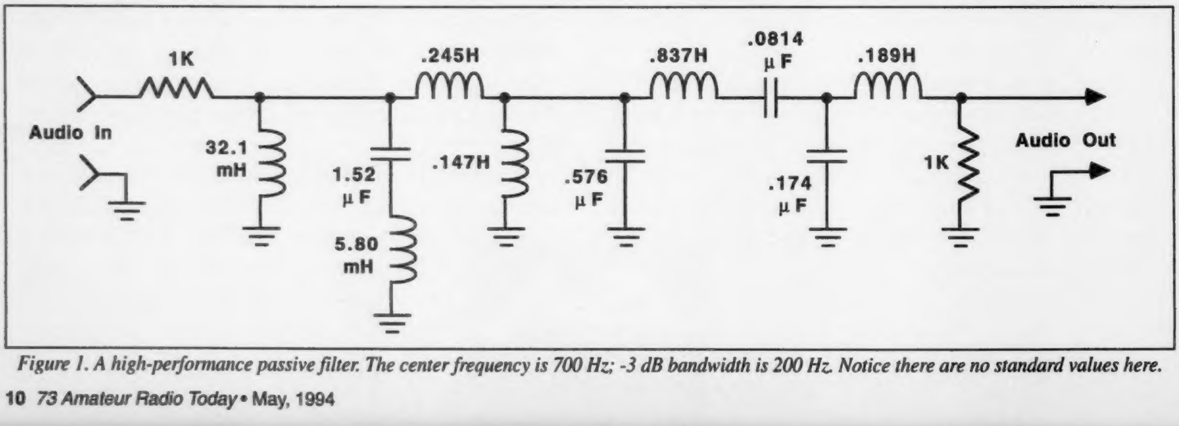

Figure 1. A high-performance passive filter. The center frequency is 700 Hz; -3 dB bandwidth is 200 Hz. Notice there are no standard values here.

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Separate full size quarter wave radiators are used on 20, 17, 15, 12, 10 and 2 Meters. On 6 Meters, the 17 Meter radiator becomes a 3/4 wave radiator.

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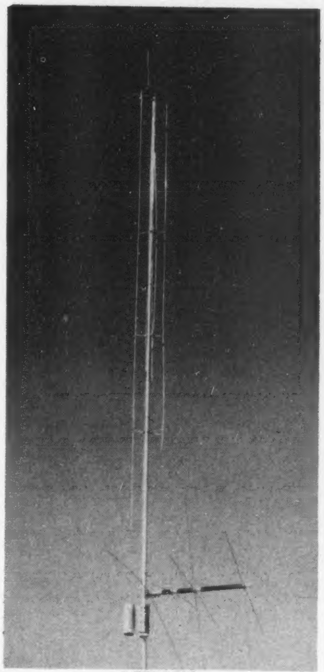

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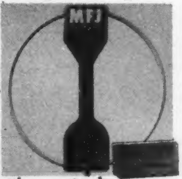
MFJ-1786 $\$299^{95}$



MFJ's *tiny* 36 inch diameter *high efficiency* loop antenna lets you operate 10 to 30 MHz *continuously* -- including the WARC bands!

It's ideal where space is limited -- apartments, small lots, mobile homes, attics, motor homes.

Enjoy both DX and local contacts when you mount it vertically. You get *both* low angle radiation for excellent DX *and* high angle radiation for local close-in contacts. Handles 150 watts.

Super easy-to-use! Only MFJ-1786 *Super* Remote Control has *Auto Band Selection*™. It auto-tunes to your desired band, then beeps to let you know. No control cable is needed.

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All *welded* construction, no mechanical joints, welded butterfly capacitor with no rotating contacts, large 1.050 inch diameter *round* radiator -- not a lossy thin flat-strip -- gives you highest possible efficiency.

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No, it's not a fan -- it's a high efficiency portable loop antenna that's about the same size and shape as a 2x2 foot box fan, complete with carrying handle.

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When you get there, set it on a table or desk and enjoy ragchewing or DXing.

All welded construction, covers 14-30 MHz *continuously* including WARC bands, handles 150 watts. Remote control has fast/slow tune buttons. Separate control cable not needed.

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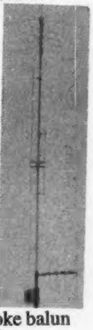

Operate 6 bands -- 40, 20, 15, 10, 6 and 2 Meters -- with this MFJ-1796 *ground independent halfwave* vertical antenna! No radials or ground ever needed!

It's only 12 feet high and has a *tiny* 24 inch footprint! Mount it anywhere from ground level to tower top -- on apartments, condos, small lots, even motor homes. Perfect for vacations, field day, DX-pedition, camping.

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Continued from page 10

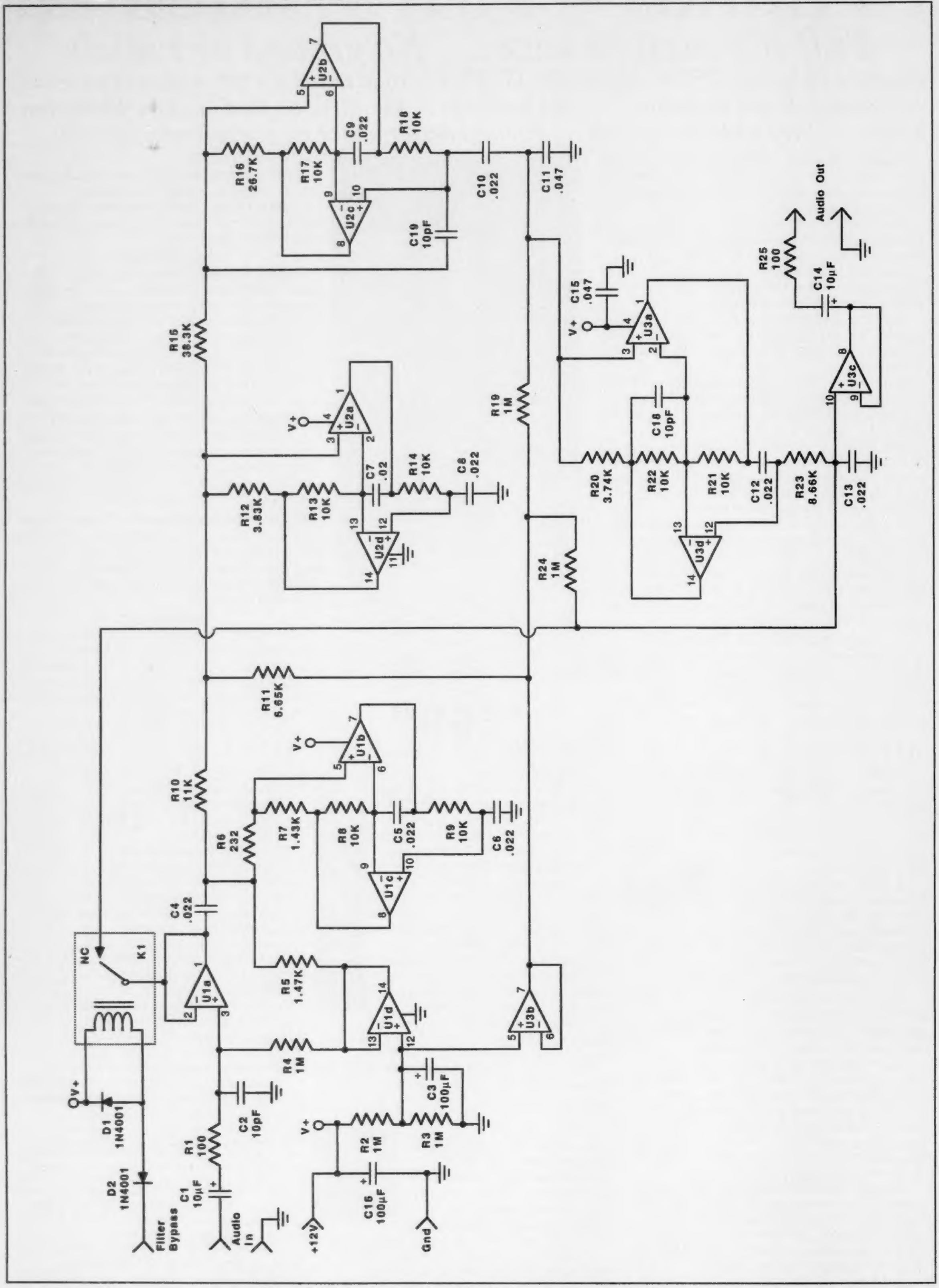
U2b
R16 26.7K
R17 10K
C9 .022
R18 10K
C10 .022
C11 .047
U2c
C19 10pF
R15 38.3K
V+
U2a
C7 .02
R14 10K
C8 .022
R12 3.83K
R13 10K
U2d
R19 1M
R24 1M
R11 6.65K
V+
U1b
R10 11K
R6 232
R7 1.43K
R8 10K
C5 .022
R9 10K
C6 .022
U1c
C4 .022
NC
K1
U1a
R5 1.47K
U1d
U3b
R4 1M
C3 100µF
V+
D1 1N4001
D2 1N4001
C2 10pF
R1 100
C1 10µF
Filter Bypass
Audio In
V+
R2 1M
R3 1M
C16 100µF
+12V
Gnd
C15 .047
V+
U3a
C18 10pF
R20 3.74K
R22 10K
R21 10K
C12 .022
R23 8.66K
C13 .022
U3d
U3c
C14 10µF
R25 100
Audio Out

Figure 2. The active version of the high-performance audio filter.

Continued on page 14

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DJ-180T
DR-130T

CIRCLE 67 ON READER SERVICE CARD

HI-PER Audio Filter

Continued from page 12

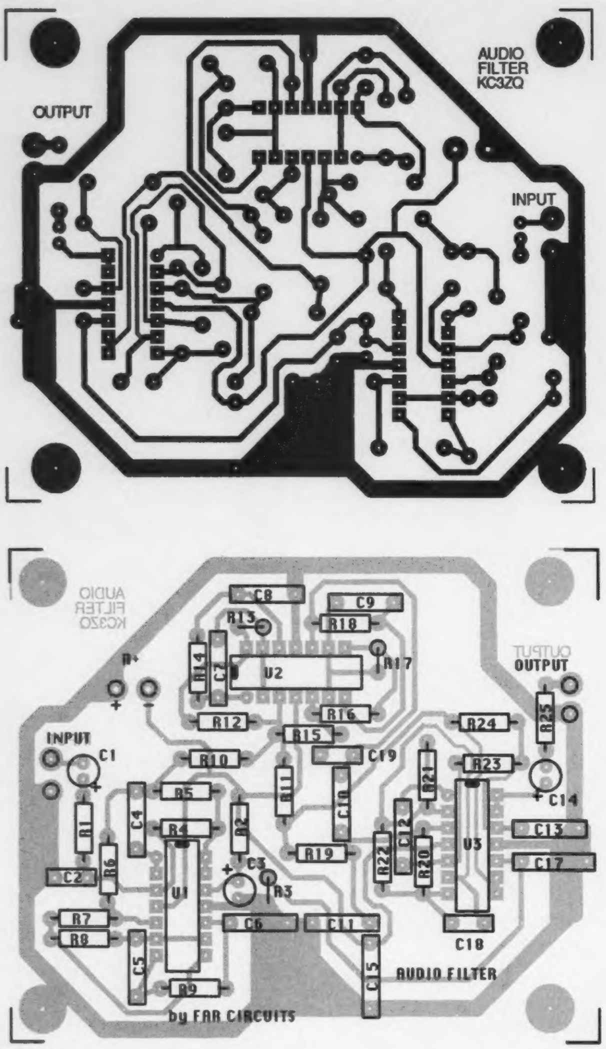

Figure 3. A drilled and etched PC board is available from FAR Circuits, 18N640 Field Court, Dundee IL 60118 for $4.50 plus $1.50 S&H per order.

tion. To activate the CW filter, a switch or relay contact within the rig must pull one terminal of the bypass relay to ground, opening the relay contacts. Those wishing to omit this feature, and operate the filter continuously may simply delete K1 and the diodes associated with it, D1 and D2.

Electrically, the filter should be mounted between the first and second audio stages in your rig. Use shielded wire to connect to the filter to help reduce RFI effects.

In operation, the performance of the filter is, in short, breathtaking. This is not your garden variety active filter here! In a noisy, interference-filled band, when the filter is switched in, everything but the desired signal falls away. After I installed this filter in my HW-100, I would have been hard pressed to distinguish between its performance and that of any of the best crystal CW filters in any other rig I have used. The lack of ringing in this filter made it better than quite a few other filters, crystal or otherwise, that I have used. This filter should give the same kind of performance to your direct-conversion rig, too.

I hope you enjoy this project, and find as much pleasure in its use as I did in its design. See you on the bands. ■

References:

1. Blinchikoff, H. and Zverev, A., *Filtering in the Time and Frequency Domains*, 1976, John Wiley and Sons, pp. 199-204.

2. Downs, Rick, "Vintage Filter Scheme Yields Low Distortion in New Audio Designs," *EDN*, November 7, 1991, pp. 267-272.

Parts List

R1,25	100 ohm
R2-4,19,24	1 meg
R5	1.47k, 1%
R6	232 ohm, 1%
R7	1.43k, 1%
R8,9,13,14, 17,18,21,22	10.0k, 1%
R10	11.0k, 1%
R11	6.65k, 1%
R12	3.83k, 1%
R15	38.3k, 1%
R16	26.7k, 1%
R20	3.74k, 1%
R23	8.66k, 1%
C1,3,14,16	100 µF electrolytic
C2,19,18	10 pF
C4-10,12,13	0.022 µF 5%
C11,15,17	0.047 µF 5%
U1-3	LM324 or equivalent quad op amp
D1,2	1N4001 or equivalent
K1	12 volt SPDT relay, RS# 275-241

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- Selectable variable speed/fixed 10Hz step VFO tuning
- Built-in 24hr clock
- 90 tunable memories
- 1 scratchpad memory
- 9 (256 character) keyboard data buffers
- Built-in 5-75 wpm IAMBIC keyer
- Built-in 2.4KHz, 1.8KHz, 500Hz, 200 Hz & RTTY filters
- Notch filter
- Select 1 of 3 antennas from front panel

Specifications are subject to change without notice.
* IBM XT is a registered trademark of the IBM Corporation.

- Basic display lets you know exactly where you are.

```
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14.03510-R    M000
```

- Standard Display shows RX/TX VFO freq's, time and current memory

- Send & Receive in: CW / RTTY(BAUDOT) / ASCII

```
TNX FER QSO, 73
█
```

← Incoming data
← Outgoing data appears here

- Store up to nine 256 character messages.
- Messages can be: edited, sent & appended to outgoing message

```
14.03510-T    0930
3>CANNED      MSG█
```

← Format & Edit stored MSG's here

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Speech Compression

Make a monster mike!

by Michael Jay Geier KB1UM

If you operate on a crowded band like 20 meters, you know that sometimes being heard can get tough. You hear the other station pretty well, but the QRM wipes you out on his end. Or, perhaps, you're on 10 meters and the QSB and generally poor conditions make it hard for anyone to hear your signal. You've got a good antenna and as much power as you can muster, so what can you do about it? Who ya gonna call? Why, Speech Busters, of course!

I'm referring to speech processing, one of the most valuable signal improvements you can make to an HF transmitter. It's valuable because the sounds made by the human voice have a particular characteristic that makes them hard to send over noisy channels.

Voice signals encompass a fairly large dynamic range. The loud sounds are really much louder than the soft ones, and there are far more soft ones than loud ones. As a result, the *average* level is way below the *peak* level. That's no problem in a nice, quiet room. And, in face-to-face contact, lip movement, facial expression and other visual cues help us fill in the blanks when sounds get lost in busy environments. On a noisy radio channel, though, the result is a mess. Without the other cues, we lose some sounds, making words harder to understand. In other words, our *intelligibility* suffers. Compounding the problem is the fact that, because the peak voice level determines the transmitter's peak power output, the *average* power output is fairly low; we're wasting a lot of our transmitter's capability. We need more "talk power." Enter the speech processor.

The function of the speech processor is to equalize the volume levels between the normally softer and louder sounds. Yes, it's a kind of distortion, but it's one that helps make the words more intelligible, even if the resulting voice quality is not as natural-sounding. The process is fairly simple: You raise the level high enough that peaks are clipped off and softer sounds are closer to the level of the now-clipped peaks. Then, you filter out all the ugly distortion you just created with the clipping by passing the signal through a narrow-bandwidth filter. Voilà, processed speech.

You really can do it that way, but it sure is hard to do at the audio level. Why? Because making a steep filter that will remove all the clipping mess but pass the desired audio frequencies is rather hard at such low frequencies. But, why not bump it all up to RF and do it there, using common crystal or ceramic filters for the cleanup gig? That's exactly what happens in an RF speech processor.

Most of today's HF rigs have RF speech processors built right in. No doubt about it, RF processing is the best kind, especially since you never need to convert the result back to audio with an internal processor. All you have to do is feed the processed RF through the sideband filter and then into the rest of the transmitter's stages. What could be easier?

If, however, you have an older rig, or you have one of the less expensive modern rigs, like my Yaesu FT-747GX, you may not have a speech processor. And, you may spend a lot of time rationalizing why you hear others so much better than they hear you. Is there a way out?

You betcha! At one time, outboard RF speech processors were available, and they worked fairly well. A good example of such a product was the Daiwa RF-440. Of course, the RF processing method is fairly complex, so these boxes weren't cheap. And, since there was no access to the radio's transmit IF stages, it was necessary to reconvert the processed signal back to audio in order to get it into the rig. But it worked, and it sure beat having no processor.

Nowadays, with most rigs having their own processors, outboard units are not very common; there just isn't enough market for them. But speech processing doesn't *have* to be done at RF. It can also be done right at the audio level. As I mentioned before, the clipping process creates problems that are hard to resolve at audio frequencies. Luckily, there's another kind of processing that doesn't involve clipping at all, and it lends itself well to simple audio circuits. It's called compression.

Squeeze Play

The object of the game is to reduce the dynamic range of the voice signal, right? Doesn't that sound similar to the function of a receiver's AGC circuit? AGC adjusts the receiver's gain to reduce the apparent dynamic range of incoming signals. Sounds like the same idea, right?

It is! And, it's not. AGC stands for Automatic Gain Control, and that's what it does: It controls the gain of the receiver to keep signal levels as constant as possible. Such a technique might be called "volume leveling." The big difference between volume leveling and speech compression is the speed at which it occurs.

Similarly, if you've ever tried to compensate for lack of a speech processor by deliberately overdriving your mike gain and relying on the transmitter's ALC to compress the signal for you, you know it doesn't work. On the air, you sound about the same as if you backed the gain down, at least until the point at which your rig begins to distort and splatter. Why doesn't it work? For the same reason a receiver's AGC doesn't compress speech: The ALC just isn't fast enough.

If you look at a voice signal on an oscilloscope, you'll see that the various sounds in a spoken word occur rather quickly. The time difference between the peaks and softer levels can be as little as 100 milliseconds. Syllables go by at maybe 300 milliseconds. AGC and ALC circuits, though, operate at speeds of perhaps one or two seconds. To be more accurate, I should say they *decay* at that rate; most attack very fast. In other words, they clamp the gain down very quickly, but it takes quite a bit of time for them to open back up.

Why doesn't AGC work faster? Well, if your receiver has a control that lets you set the AGC to "fast," you'll find out! Try it and you'll see that people's voices do sound compressed, but all the background noise, static and QRM also "pump" up and down, making it hard to listen to. It'll give you a headache real fast. That's why the process must be done at the transmitter. As for transmitter ALC, it could be made to be faster, and it would indeed act as a speech compressor. But, there's a big drawback which prevents rig makers from doing it that way: It takes a finite amount of time for the circuit to act, resulting in some overshoot (delay in clamping) on voice peaks. It isn't practical to filter out the resulting distortion and splatter in a 100-watt signal, because such narrow filters must be made from crystals or ceramics, and they can only handle small amounts of power. So, ALC-based compression generally is out of the question. I believe, how-

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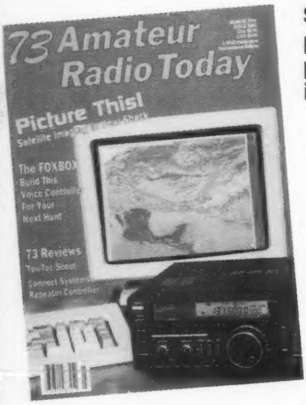

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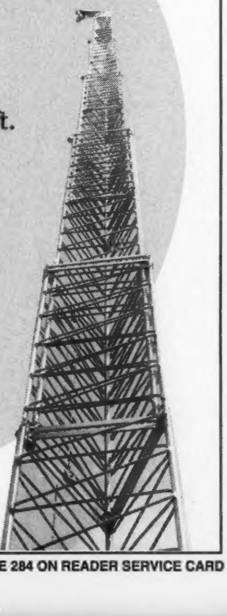

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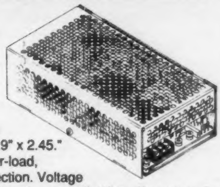

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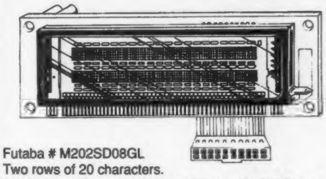

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Speech Compression

Continued from page 16

ever, that Drake used to have a rig with fast ALC for speech processing use. Also, there's a new linear amplifier which does it, too. So, I guess it can be done, but it isn't common.

So, we're back to compressing the audio before it goes into the transmitter. There have been many circuit designs published, and various commercial products, which do the job. I've tried building a few compressors, and I've played with a few commercial boxes, and even bought one, but none of them really made much difference on the air. In fact, it was always hard for the receiving station to tell whether I had the darned thing on or off! Why?

It's the same old problem: The things operate too slowly. They make lovely volume levelers, but they don't actually compress speech at the syllabic rate, which we need if we're going to increase our talk power. Here's what happens when you use most audio compressors: The first loud sound in a sentence clamps the gain down, where it stays pretty much permanently, because, by the time it starts to open back up, other loud sounds have clamped it down again. The softer syllables in between the loud ones never get cranked up, so there's no increase in talk power. For a compressor to increase talk power, *it must have time constants which are as fast or faster than the syllabic rate of speech.* That way, it can open the gain back up for the softer syllables, thus making their levels closer to those of the now-clamped peaks. That's *real* speech compression, and it does indeed up your talk power! On a scope, the output of the rig looks similar to what you get with an RF processor.

The Monster Compressor 85

I recently purchased a Kenwood MC-85 desk microphone. This lovely unit has a condenser mike, switch-selectable outputs for three rigs, and a built-in volume-leveling compressor. Almost all of Kenwood's newer HF radios have internal RF speech processors, so the volume leveling approach is a nice complement to what's inside most of the rigs to which this mike is likely to be connected. (A syllabic-rate compressor feeding a speech processor would be *extreme* overkill.) But I got my MC-85 for use with my processor-less '747GX, so I decided to try and modify the mike's compressor into a true syllabic-rate speech compressor. The mod works like gangbusters.

Charge It

Imagine, if you will, an amplifier whose output signals are inverted and then fed back to a terminal which controls the amplifier's gain. As the output signal rises, the gain is pulled down. And, as the output falls, the gain is increased. Sounds like a compressor, right? Well, all except for one thing: If the control terminal is moved up and down as fast as the waveform coming from the amp's output, the result will be that the output signal completely disappears! It makes sense; each swing of the output cancels itself out. The way around this is to slow the loop down. As long as the loop cannot alter the amp's gain anywhere nearly as fast as the output signal swings, it won't wipe itself out. To that end, there's always a capacitor in the loop. Together with a resistor or two, that capacitor forms a *time constant*, preventing the loop from being too fast.

The primary modification to the MC-85's circuit involves changing the time constant in the feedback loop, making it just fast enough to catch spoken syllables. A few other changes also are necessary because of peripheral consequences of the change in the loop.

How It Works

Take a look at Figure 1. IC1 is the amplifier. The input is through pin 2, and possibly also pin 6. It isn't clear from the schematic, but it also doesn't matter for our purposes. What does matter is that the output is from pin 8, and the loop starts at the junction of C11 and C12. The output signal is fed through R13 to the base of Q2, which inverts it. C13, at the transistor's collector, removes the DC component, leaving an AC signal which can be rectified by D4 and D5. The rectified signal charges C14, which is the magic capacitor that sets the time constant. It is important to recognize that, because of D4, the capacitor cannot *discharge* back into the transistor. That feature lets the processor's attack and decay times, which are determined by the capacitor's charge and discharge rates, be determined separate from each other. As originally designed, the attack is quick because R17, between the transistor and the capacitor, is small, permitting a

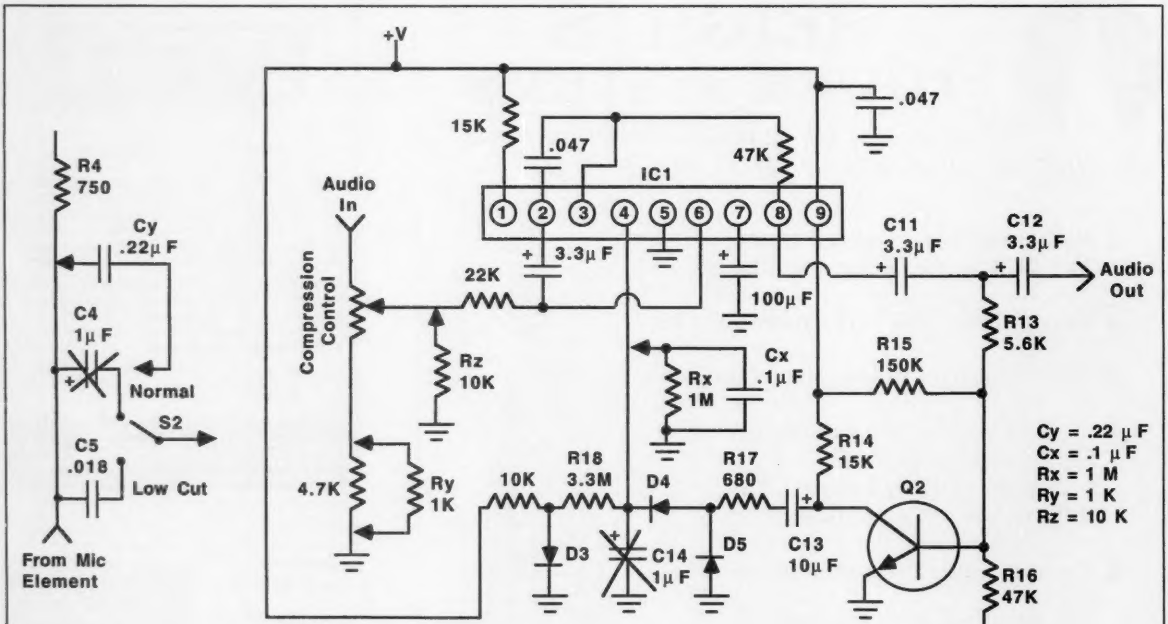

Figure 1. The Monster Compresser 85. Schematic shows modification to Kenwood's MC-85 Desk Microphone.

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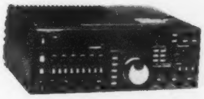

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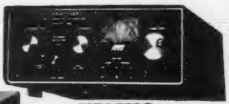

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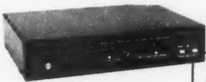

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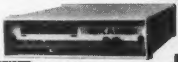

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comparatively large current to flow. (We're still talking about maybe 0.3 milliamps here!) But the cap can only discharge through two places: the amp chip's gain control terminal itself (pin 4), and the R18/D3 combination. The amp chip has very high input impedance, so it can be disregarded. But, take a look at R18, which allows the cap to discharge to ground through D3. That resistor is 3.3 *megohms*, which ain't small change either! The result is that the cap discharges quite slowly, accounting for the compressor's slow decay time.

That decay time is precisely what we want to speed up. So, it would seem logical that we could simply reduce the value of R18. It should work, but, when I tried it, the results were poor. In order to get it fast enough, the value had to be so low that it divided the voltage down to less than what the chip could sense. So, I decided to reduce the size of the cap. After some experimentation, I wound up with a 0.1 µF cap in parallel with a 1-meg resistor; that combination yielded a time constant that sounded about right; syllables were getting boosted, but distortion was acceptably low.

Distortion?

Remember what I said before about the output's disappearing if we allow the loop to be too fast? Well, think of the loop as a low-pass filter, which really is just what it is. If we don't slow it down enough, low audio frequencies will get through and begin to cancel their counterparts in the output, and that means distortion. It gets worse: In this design, Q2 is not operated as a linear amplifier. It is biased to be a pulse amplifier, and it produces pulses which correspond to the peaks in the amp's output signal. Residual pulses being fed back to the amp cause terrible distortion, so they must be kept very low. That requirement resulted in my having to choose the time constant very carefully. Too fast and it sounded awful. Too slow and it didn't accomplish anything!

Uh Oh

After I found the right time constant, I discovered that the overall gain of the circuit had gone way up. Apparently, the DC path of the 1 meg resistor increased the chip's gain. Not having a diagram of the interior of the chip, I can't tell you why. With the gain so high, turning the compression control up past 6 or so caused the entire circuit to go into oscillation! The solution was easy, though. Resistors Y and Z tailor the input gain such that the circuit remains stable. Even with them in place, the compression control doesn't need to be turned up past about 3.

One Last Detail

Male voices contain most of their energy at fairly low frequencies. Also, the gain of the circuit goes up somewhat as the input frequency goes down, exacerbating the problem. The result was that, with the NORMAL/LOW CUT switch (S2) in the NORMAL position, it still was possible for some instability and oscillation to occur. I noticed that the audio was a little bassy anyway, so I changed C4 from 1 µF to 0.22 µF to provide additional low-frequency rolloff. Finally, everything worked great, and the audio sounded excellent.

Let's Do It

Unscrew the bottom of the housing and then unscrew the sides. With the mike facing down (the foil side of the board facing you) and the output cord (or cords) facing away, the SIP (single inline package) IC1 is near the bottom left edge. You'll have to turn the board over to see it, of course. The clipped corner or engraved dot of the chip denotes pin 1. Depending on your dexterity, you may need to unscrew the PC board frame from the rest of the housing, but it is possible to do the mod without doing that. Either way, find C14, a small electrolytic, which is connected between the IC's pin 4 and ground, and remove it. Install in its place a 0.1 µF cap in parallel with a 1 meg resistor. I put mine on the foil side of the board, simply because it was easier to install. Functionally, it doesn't matter.

Now, look over toward the bottom right and find the compression control's connections. When connecting the 1k and 10k resistors, use the ground foil on the left, not the one on the right; the one on the left is closer to the amp circuitry and less likely to introduce ground loop or RF feedback problems. Solder the resistors in place on the foil side.

Finally, you must remove C4, which is another electrolytic. It is located just under the cover, on the component side of the board, which is part of the button assembly. The cap is right on the edge of the assembly, and I was able to remove it with tweezers after desoldering the leads with removal wick. If you can't get the cap out that way, you will have to unscrew the button housing. Be careful not to lose anything! Once the cap is out, replace the assembly if you had to remove it. Now, solder a 0.22 µF cap in its place, but on the foil side of the board. Most likely, a cap of that value will be too big to fit under the button housing anyway.

Finished

That's it! Close it all back up again and you should be in business. Turn the mike on, select COMP IN and speak about a foot away from it. The level meter should look a lot more energetic than it used to! I find that a compression control level of about 3 works fine. Any more than that and it sounds over-compressed.

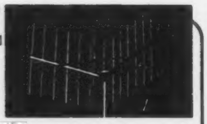
The Caveat

Be warned: This thing will run your rig a lot harder than it ran without it! Your finals will heat up much faster. On my FT-747, the fan never used to come on during voice operation, but it sure does now. That extra heat, of course, means increased average transmit output level, which means extra talk power!

On the Air

Although the NORMAL position works fine, I find that with LOW CUT on there's more punch. As for the compressor, on-air reports indicate that the difference between turning it on and leaving it off is like night and day. And I've gotten several unsolicited comments on how great the mike sounds. Enjoy your Monster Compressor 85!

P.S.—Recently, I began to have RF feedback trouble with my modified MC-85. I traced it to a poor connection between the gooseneck and its base, which results in reduced shielding of the mike cartiridge. It probably was always like that, but adding strong compression made it appear much worse. If you run into this, check the resistance between the setscrew on the mike element housing and the frame holding the PC board inside the unit. If its more than about 0.1 ohm, you've found the culprit. (Mine was about 10 ohms!) Unfortunately, the metals used at the critical junction won't take solder. I fixed mine with two small hose clamps and a piece of ground braid, after first sanding the connection points. It works, but it aint pretty. For nicer looks, you could drill a small hole in the base and insert a set screw for a good connection, just as long as you're careful not to go through the gooseneck and damage the cable. My mike works great now.

CornerBeam?

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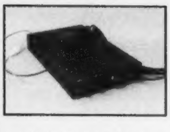

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CHR, Matching case	$12.95

Miniature SPEAKER-MIKE

Fits Icom, Yaesu, Alinco, Ramsey and Radio Shack rigs! Looking for a handy little speaker-mike to compliment your FX transceiver or other ICOM style handie-talkie? The Ramsey SM-1 speaker-mike is a beauty. It's only 1 1/2" wide by 2 1/2 inches high and has a handy clip on the back so you can easily clip it to your lapel or shirt. Its small internal speaker isn't going to break any eardrums but is very clear and has plenty of pop to be heard when worn. There's even a jack on the mike so when you plug it in, you still have the use of the speaker jack from your radio. Fits all Radio Shack, ICOM, Yaesu, Alinco and Ramsey rigs.

SM-1 Mini-Speaker mike, Fully assembled	$24.95

CW KEYER

Send perfect CW. Microprocessor keyer features 4 programmable memories of up to 26 words each, Iambic keying, dot-dash memory, variable speed from 3-60 WPM, adjustable sidetone, keying to any rig and fully RFI proof. EAROM memory keeps messages up to 100 years - you'll go silent before the key! Includes built-in touch paddles or use your own. Easy assembly and matching case set available for a nice station look.

CW-700 Micro keyer kit	$69.95	MK Matching case set	$12.95
CW-700WT Assembled CW-700and case			$99.95

ACTIVE ANTENNA

Cramped for space? Get longwire performance with this desktop antenna. Properly designed unit has dual HF and VHF circuitry and built-in whip antenna, as well as external jack. RF gain control and 9V operation makes unit ideal for SWLs, traveling hams or scanner buffs who need hotter reception. The matching case and knob set gives the unit a hundred dollar look!

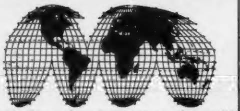
AA-7Kit	$24.95	Matching case & knobset, CAA	$12.95

AIRCRAFT RECEIVER

Hear exciting aircraft communications—pick up planes up to 100 miles away! Receives 110-136 MHz AM air band, smooth varactor tuning superhet with AGC, ceramic filter, adjustable squelch, excellent sensitivity and lots of speaker volume. Runs on 9V battery. Great for air shows or just hanging around the airport! New 30-page manual details pilot talk, too. Add case set for "pro" look.

AR-1 kit	$24.95
Matching case set, CAR	$12.95

SHORTWAVE RECEIVER



Fantastic receiver that captures the world with just a 12" antenna! Can receive any 2 MHz portion from 4-11 MHz. True superhet, has smooth varactor tuning. AGC, RF gain control, plenty of speaker volume and runs on a 9V battery. Fascinating Scout, school or club project, provides hours of fun for even the most serious DXer. For the car, consider our shortwave converter. Two switchable bands (in 3-22 MHz range), each 1 MHz wide—tunable on your car radio dial. Add some interest to your drive home!

Shortwave receiver kit, SR1	$29.95
Shortwave converter kit, SC1	$27.95
Matching case set for SR1, CSR	$12.95
Matching case set for SCI, CSC	$12.95

2M POWER AMP

Easy to build power amp has 8 times power gain, 1W in, 8W out, 2W in, 16W out, 5W is for 40W out. Same amp as featured in many ham magazine articles. Complete with all parts, less case and T-R relay.

PA-1, 40W pwr amp kit	$34.95
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MORE KITS NEXT MONTH'S ISSUE

MINI KITS

Ramsey carries a complete line of low cost, easy to build, easy to use functional kits that can be used alone or as building blocks in larger more complex designs. Mini-kits include audio amps, tone decoders, VOX switches, timers, audio alarms, noise-makers and even shocking kits! Call for our free catalogue!

FOXHUNT HEADQUARTERS

Locate hidden or unknown transmitters fast. The Foxhound direction finder connects to the antenna and speaker jack on any radio receiver, AM or FM from 1 MHz to 1 GHz. The antenna (a pair of dipole telescopic whips) is rotated until the Null meter shows a minimum. A pair of LEDs indicate to turn Left or Right. The Foxhound is ideal to use with a walkie-talkie. if you wish to transmit, go ahead, a built-in T/R switch senses any transmitted RF and switches itself out of circuit while you talk. It doesn't get any easier than this! We provide all parts except for a few feet of 1/2 inch PVC pipe avialable at any hardwar e store for a dollar or two. Add our matching case set for a complete finished unit. Be the one with the answers, win those transmitter hunts and track down those jammers, you'll do it all with your Foxhound.

Add some fun to your club events by having a transmitter hunt! Foxhunting is a craze sweeping the nation, but many clubs are missing out on the action because they lack the expertise or time to develop their own foxhunt transmitter. We set one of our most devious and sneaky engineers to the task of designing an easy to build and use, yet highly capable Foxhunt transmitter. A snazzy microprocessor controller has both preset and programmable transmission characteristics allowing you to easily set the difficulty level from "beginner" to "know-it-all"! The SlyFox, FHT-1, is crystal controlled in the 2 meter band (crystal for 146.52 included) with a power output of 5 watts that is adjustable by the controller.The transmitter is programmed to ID in CW or add our voice option if you really want to aggravate the troops - "Ha ha, you can't find me!" Join the fun, get rid of those stuffy old meetings and picnics. have a foxhunt!

DF-1 Foxhound direction finder kit	$59.95	CDF Matching case set for DF-1	$12.95
FHT-1 SlyFox Foxhunt transmitter kit	$129.95	FHID-1 Voice ID option	$29.95
CFHT Heavy duty metal matching case set for FH T-1			$29.95

PACKET RADIO

Two new versions are available for the Commodore 64 (P-64A) or the IBM-PC (P-IBM). Easy assembly NO TUNING". Includes FREE disk software. PC Board and Full Documentation. Kit form.

P-64A	$59.95	P-IBM	$59.95	CASE CPK	$12.95

STEREO FM TRANSMITTER

Run your own Stereo FM radio station! Transmits a stable signal in the 88-108 MHz FM broadcast band up to 1 mile. Detailed manual provides helpful info on FCC regs, antenna ideas and range to expect. Latest design features adjustable line level inputs, pre-emphasis and crystal controlled subcarrier. Connects to any CD or tape player, mike mixer or radio. Includes free tuning tool too! For a pro look add our matching case set with on-board whip antenna

FM-10A Stereo transmitter kit	$34.95
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SS-70 Scrambler /descramblerkit	$29.95
CSSD matching case set	$12.95
SS-70WT Assembled SS-70 and case set	$69.95

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DN-1 Dr. Ni-Cad conditioner/fast charger kit	$49.95
CDN Matching case set	$12.95
DN-1WT Fully assembled Dr. Ni-Cad with case	$89.95

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Fast Charger

Recharge NiCd and NiMH batteries in as little as 30 minutes.

by Richard Togashi KN6PK

Why another NiCd battery recharging article? Well, Fast Charger will not only recharge NiCds, it will fast charge them to the correct capacity in as little as 30 minutes. After fast charging, the circuit will then automatically switch to trickle charge. Any number of cells can be recharged, up to a maximum of 16 cells. Programming jumpers allow different charging rates and different cell counts without any circuit modification. And with a single part replacement, the circuit will charge the new Nickel Metal Hydride (NiMH) batteries.

NiCds are a proven technology in batteries, relatively inexpensive, available in all popular sizes, easy to use and easy to abuse. NiCds, when fully charged, exhibit a decrease in battery output voltage. Fast Charger detects this voltage change during fast charging to ensure the batteries are at full charge capacity. After a full capacity charge, Fast Charger will revert to a trickle charge state, allowing the batteries to be at a full charge state indefinitely.

NiMH batteries are a little different; they are an emerging technology. They are similar to NiCds, but they boast higher current densities than NiCds and there is none of the memory effect NiCds are prone to. There are some drawbacks to the NiMH, since it is a new technology: They are in short supply, are available only in limited sizes, are more expensive, self-discharge faster, and have approximately 80% of the recharging cycles found in NiCds. For high current demand or cyclic applications, NiMHs may be a better choice than NiCds. NiMH batteries require a different recharging scheme. They exhibit a voltage plateau when they are fully recharged. By interchanging an inexpensive IC with a similar device, Fast Charger will be able to detect the NiMH recharging characteristics. This will also allow the NiMH batteries to be charged to the full capacity in a minimum amount of time.

Normal battery chargers charge the batteries at C/10 (where C = capacity) with a constant current for approximately 16 hours.

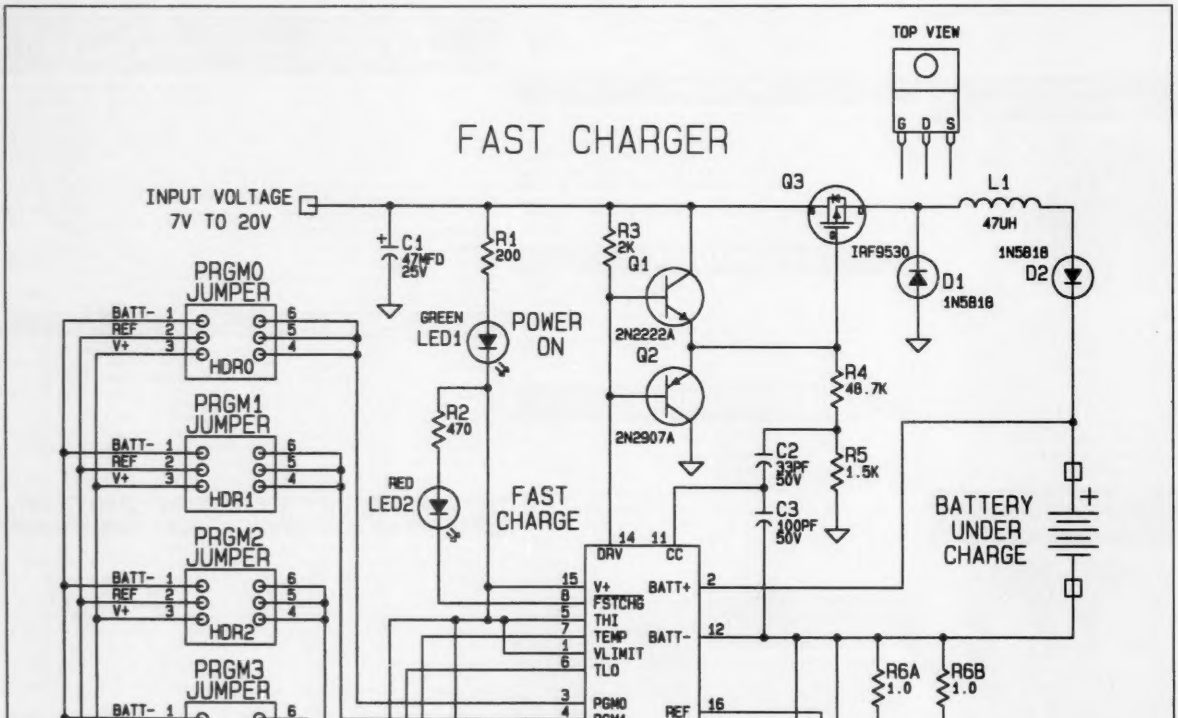
FAST CHARGER
TOP VIEW
G D S
INPUT VOLTAGE 7V TO 20V
C1 47MFD 25V
R1 200
R3 2K
Q1 2N2222A
Q2 2N2907A
Q3 IRF9530
L1 47UH
D1 1N5818
D2 1N5818
GREEN LED1
POWER ON
R2 470
RED LED2
FAST CHARGE
R4 48.7K
R5 1.5K
C2 33PF 50V
C3 100PF 50V
BATTERY UNDER CHARGE
+
PRGM0 JUMPER
PRGM1 JUMPER
PRGM2 JUMPER
PRGM3 JUMPER
BATT- 1
REF 2
V+ 3
6
5
4
HDR0
HDR1
HDR2
HDR3
14 DRV
11 CC
15 V+
8 FSTCHG
5 THI
7 TEMP
1 VLIMIT
6 TLO
3 PGM0
4 PGM1
9 PGM2
10 PGM3
BATT+ 2
BATT- 12
REF 16
GND 13
IC1
MAX713
R6A 1.0
R6B 1.0
C4 1MFD 25V

Figure 1. Schematic for the Fast Charger.

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MODEL VS-50M

ASTRON POWER SUPPLIES

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- FOLD-BACK CURRENT LIMITING Protects Power Supply from excessive current & continuous shorted output
- CROWBAR OVER VOLTAGE PROTECTION on all Models except RS-3A, RS-4A, RS-5A, RS-4L, RS-5L
- MAINTAIN REGULATION & LOW RIPPLE at low line input Voltage
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- ONE YEAR WARRANTY • MADE IN U.S.A.

PERFORMANCE SPECIFICATIONS

- INPUT VOLTAGE: 105-125 VAC
- OUTPUT VOLTAGE: 13.8 VDC ± 0.05 volts (Internally Adjustable: 11-15 VDC)
- RIPPLE Less than 5mv peak to peak (full load & low line)
- All units available in 220 VAC input voltage (except for SL-11A)

SL SERIES

- LOW PROFILE POWER SUPPLY

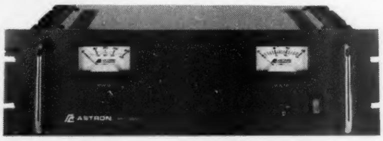
MODEL	Colors Gray	Colors Black	Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H × W × D	Shipping Wt. (lbs.)
SL-11A	•	•	7	11	2⅝ × 7⅝ × 9¾	12
SL-11R	•	•	7	11	2⅝ × 7 × 9¾	12
SL-11S	•	•	7	11	2⅝ × 7⅝ × 9¾	12
SL-11R-RA		•	7	11	4¾ × 7 × 9¾	13

RS-L SERIES

- POWER SUPPLIES WITH BUILT IN CIGARETTE LIGHTER RECEPTACLE

MODEL	Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H × W × D	Shipping Wt. (lbs.)
RS-4L	3	4	3½ × 6⅛ × 7¼	6
RS-5L	4	5	3½ × 6⅛ × 7¼	7

RM SERIES



MODEL RM-35M

- 19″ RACK MOUNT POWER SUPPLIES

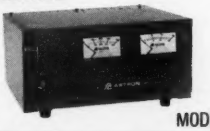
MODEL	Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H × W × D	Shipping Wt. (lbs.)
RM-12A	9	12	5¼ × 19 × 8¼	16
RM-35A	25	35	5¼ × 19 × 12½	38
RM-50A	37	50	5¼ × 19 × 12½	50
RM-60A	50	55	7 × 19 × 12½	60
• Separate Volt and Amp Meters				
RM-12M	9	12	5¼ × 19 × 8¼	16
RM-35M	25	35	5¼ × 19 × 12½	38
RM-50M	37	50	5¼ × 19 × 12½	50
RM-60M	50	55	7 × 19 × 12½	60

RS-A SERIES

MODEL RS-7A

MODEL	Colors Gray	Colors Black	Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H × W × D	Shipping Wt. (lbs.)
RS-3A		•	2.5	3	3 × 4¾ × 5¾	4
RS-4A	•	•	3	4	3¾ × 6½ × 9	5
RS-5A		•	4	5	3½ × 6⅛ × 7¼	7
RS-7A	•	•	5	7	3¾ × 6½ × 9	9
RS-7B	•	•	5	7	4 × 7½ × 10¾	10
RS-10A	•	•	7.5	10	4 × 7½ × 10¾	11
RS-12A	•	•	9	12	4½ × 8 × 9	13
RS-12B		•	9	12	4 × 7½ × 10¾	13
RS-20A	•	•	16	20	5 × 9 × 10½	18
RS-35A	•	•	25	35	5 × 11 × 11	27
RS-50A	•		37	50	6 × 13¾ × 11	46
RS-70A	•		57	70	6 × 13¾ × 12⅛	48

RS-M SERIES



MODEL RS-35M

MODEL	Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H × W × D	Shipping Wt. (lbs.)
• Switchable volt and Amp meter				
RS-12M	9	12	4½ × 8 × 9	13
• Separate volt and Amp meters				
RS-20M	16	20	5 × 9 × 10½	18
RS-35M	25	35	5 × 11 × 11	27
RS-50M	37	50	6 × 13¾ × 11	46
RS-70M	57	70	6 × 13¾ × 12⅛	48

VS-M AND VRM-M SERIES

MODEL VS-35M

- Separate Volt and Amp Meters • Output Voltage adjustable from 2-15 volts • Current limit adjustable from 1.5 amps to Full Load

MODEL	Continuous Duty (Amps) @13.8VDC	Continuous Duty (Amps) @10VDC	Continuous Duty (Amps) @5VDC	ICS* (Amps) @13.8V	Size (IN) H × W × D	Shipping Wt. (lbs.)
VS-12M	9	5	2	12	4½ × 8 × 9	13
VS-20M	16	9	4	20	5 × 9 × 10½	20
VS-35M	25	15	7	35	5 × 11 × 11	29
VS-50M	37	22	10	50	6 × 13¾ × 11	46
• Variable rack mount power supplies						
VRM-35M	25	15	7	35	5¼ × 19 × 12½	38
VRM-50M	37	22	10	50	5¼ × 19 × 12½	50

RS-S SERIES

MODEL RS-12S

- Built in speaker

MODEL	Colors Gray	Colors Black	Continuous Duty (Amps)	ICS* Amps	Size (IN) H × W × D	Shipping Wt. (lbs.)
RS-7S	•	•	5	7	4 × 7½ × 10¾	10
RS-10S	•	•	7.5	10	4 × 7½ × 10¾	12
RS-12S	•	•	9	12	4½ × 8 × 9	13
RS-20S	•	•	16	20	5 × 9 × 10½	18
SL-11S	•	•	7	11	2¾ x 7⅝ x 9¾	12

*ICS—Intermittent Communication Service (50% Duty Cycle 5min. on 5 min. off)

CIRCLE 16 ON READER SERVICE CARD

These chargers are simply unregulated constant current supplies. On the other hand, Fast Charger is controlled by the Maxium Products MAX712 or MAX713 integrated circuits, allowing a fast high current charge without damage to the batteries. The MAX712 part is used to recharge NiMH batteries. The MAX713 is used to recharge NiCd batteries. The only difference between the parts is the way the part detects the end of a fast charge cycle. The MAX712 detects the end of a fast charge cycle when the battery voltage plateaus; the MAX713 detects the end of a fast charge cycle when the battery voltage starts to decline. When the MAX712/3 senses these output voltage behaviors, it automatically switches to trickle charge. Trickle charge is also reached when the MAX712/3 determines that a maximum expected recharge time interval has elapsed.

Circuitry and Pin Programming

My prototype layout uses a hand-drawn PC board. The only critical signals are the capacitors connected to pin 11 of the MAX712/3 device. These connections should be as short as possible. The other critical path is the inductor, diodes and transistor, which constitutes a switching power supply. The traces to these devices should be as short as possible to reduce the stray inductance/resistance, which will degrade the efficiency of the switching power supply.

The MAX chip contains circuitry that does most of the work. A voltage regulator regulates the output voltage to recharge the batteries, a current-sensing amplifier senses the current through the battery and adjusts the output drive of the pass transistor to control the current into the battery. A temperature sensor option is not utilized in this design. An analog-to-digital circuit samples the battery voltage and determines the output voltage of the battery over time. A timer circuit monitors the charge times and issues a time-out if the expected recharge time has been reached. Finally, control logic monitors the four program pins of the device and controls timing internal to the device.

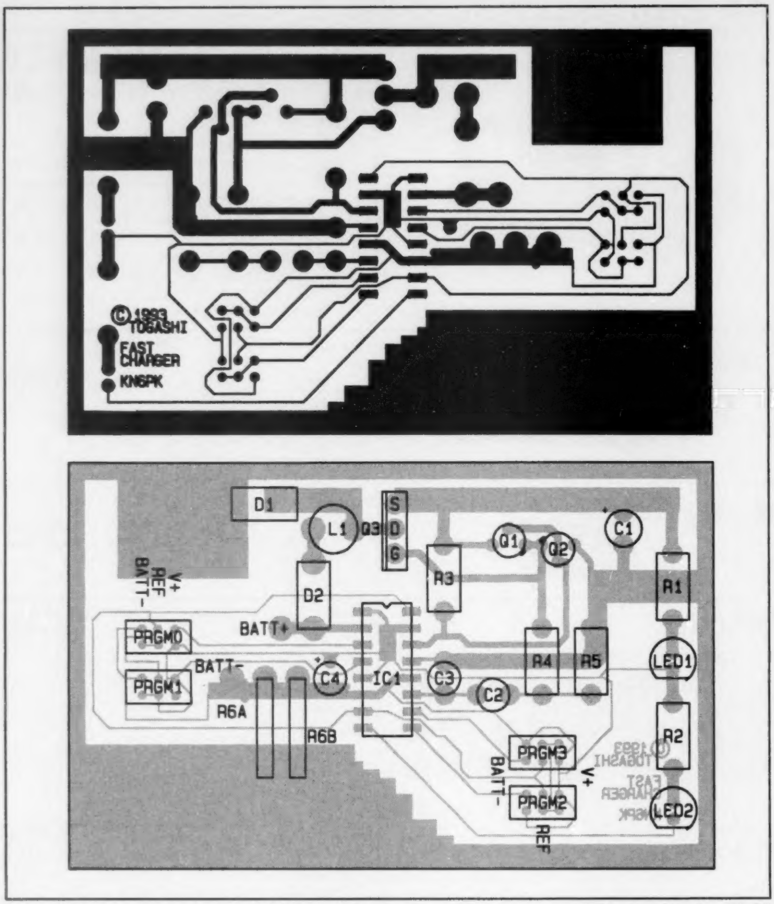


Figure 2. A drilled and etched PC board for the Fast Charger is available for $5 plus $1.50 S & H per order from Far Circuits, 18N640 Field Court, Dundee, IL 60118.

The four program pins of the device set the battery cell count and the expected recharge time. Program pins PRGM0 and PRGM1 set the cell count, the number of cells which the recharger is set to recharge. The cell count is made by either counting the cells or dividing the expected output voltage by 1.2 volts. In my application with four cells, PRGM1 and PRGM0 are shorted to BATT- and V+ respectively. PRGM2 and PRGM3 program pins set the time-out period for the expected recharge time. To determine the expected recharge time, first pick the recharge rate for the circuit. In my de-

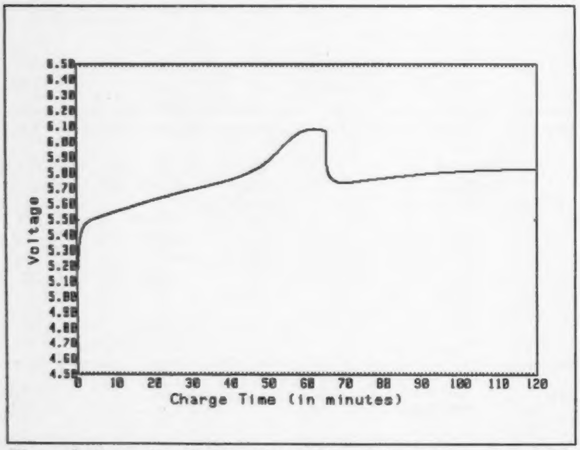


Figure 3. Operating characteristics when recharging a typical NiCd battery.

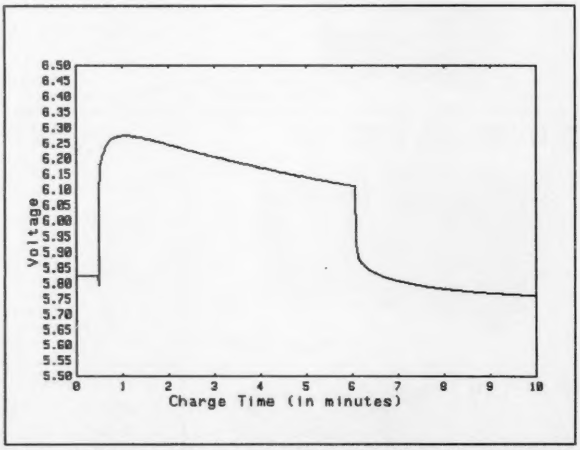


Figure 4. The same battery pack subjected to Fast Charge after the pack has been fully charged. Note the quick switch to trickle charge.

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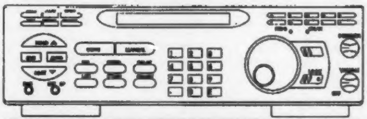

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CIRCLE 356 ON READER SERVICE CARD

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Sangean ATS606P-H shortwave with antenna & AC adapter	$169.95
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sign, the batteries I want to recharge are AA 500 mA per hour cells. I set Fast Charger to recharge the cells at 1 times the capacity, or 1C. Rechargeable batteries are not 100% efficient when recharged, so the expected recharge time is approximately 20% higher than the expected time, hence for 1C recharge rate, the expected recharge time is about one hour and 15 minutes. The closest time interval available for a one hour and 15 minute time-out is 90 minutes, which is enabled by shorting PRGM2 and PRGM3 to the REF voltage pin.

Table 1 defines the program pin programming to select the desired settings for the number of cells and for the time period. The Charge Rate in C is the charge rate as set by R6. I use jumper blocks with shorting blocks (like the ones used in PCs to set up the expansion cards) to set the programming options. DIP switches or jumpers can also be used. PRGM3 also sets the trickle charge current value. When PRGM3 is open, the trickle charge current is the fast charge rate divided by 32. When PRGM3 is connected to REF, the trickle charge current is the fast charge rate divided by 16. When PRGM3 is connected to BATT-, the trickle charge current is the fast charge rate divided by 8. My application uses the PRGM3 pin tied to REF, so my trickle charge rate is 500 mA divided by 16, or 31 mA.

Q1-Q3, L1, D1 and D2 form a DC-DC switching power supply which supplies a current source to the batteries with overvoltage protection. D1 and D2 are Schottky Barrier Rectifiers which have low-forward voltage drops and are fast devices (low internal capacitance) to keep the DC-DC converter at peak efficiency. Q1 and Q2 boost the drive to Q3, turning Q3 on hard and off hard. Q3 was chosen for the low drain to source resistance of 0.3 ohms. With such a low drain to source resistance, no heat sink is required for Q3, i.e. Power Dissipation = (drain current)^2 x (drain to source resistance) which is below 100 milliwatts. L1 is charged by Q3. When Q3 turns on, current is stored in L1 and discharges through D2 into the battery. When Q3 turns off, current will continue to flow through L1 from the current stored in L1 and through D1. L1 must be both electrically large to accommodate the large current flow and physically large to prevent saturation (saturation is when L1's core cannot hold any more magnetic flux, causing L1 to look like a resistor with a resistance value of the inductor wire). For topology buffs, the topology used here is the Positive Buck Converter.

LED1 and LED2 are used for charging indicators. When power is applied to Fast Charger, LED1 illuminates. When fast charging is active, both LED1 and LED2 illuminate. When fast charging is complete, LED2 extinguishes and LED1 remains on.

Power to the Fast Charger requires a 1 volt input voltage over the highest battery voltage, with a minimum voltage of 7 volts and a maximum voltage of 20 volts. The maximum battery voltage is: (1.65 volts) x (the number of cells). The minimum current required is equal to the fast charge current. I built my Fast Charger to run off a car battery to recharge RC Slope Glider batteries. If home use is expected, then a wall-mount transformer with the appropriate DC output voltage and current is all that is needed.

PRGM 1 and PRGM 2 Pin Connections to Define Cell Count

No. of Cells	PRGM1 Connection	PRGM0 Connection
1	V+	V+
2	open	V+
3	REF	V+
4	BATT-	V+
5	V+	open
6	open	open
7	REF	open
8	BATT-	open
9	V+	REF
10	open	REF
11	REF	REF
12	BATT-	REF
13	V+	BATT-
14	open	BATT-
15	REF	BATT-
16	BATT-	BATT-

PRGM 2 and PRGM 3 Connections to Define Time-out to Trickle Charge and Associated Charge Rate

Time-out (minutes)	Charge Rate in C	PRGM3 Connection	PRGM2 Connection
22	not used	V+	REF
33	not used	V+	BATT-
45	2.0C to 1.5C	open	REF
66	1.4C to 1.1C	open	BATT-
90	1.0C to 0.8C	REF	REF
132	0.7C to 0.5C	REF	BATT-
180	0.4C	BATT-	REF
264	0.25C	BATT-	BATT-

Table 1. To control the charge rate, the current sensing resistor must be chosen. First pick the rate to recharge the batteries (between 0.25C and 2C). The current sensing resistance value is: R6 = (0.25 volts) / [(fast charge rate) x (battery capacity)]. I require a rate of 1C for my 500 mA/hour batteries, so the resistor value is calculated as follows: R6 = (0.25 volts) / [(1C) x (0.5 A/hours)] = 0.5 ohms.

Parts List

Part	Description	Digi-Key #	Price ($)
C1	Capacitor, 47 uF 25V	P5696	0.24
C2	Capacitor, 33 pF	P4018	0.06
C3	Capacitor, 100 pF	P4024	0.06
C4	Capacitor, 1 uF 25V	P6742	0.53
D1,D2	Diode, 1N5818	1N5818	0.56
IC1	IC, MAX713 or MAX712	MAX713CPE MAX712CPE	6.27
L1	Inductor, 47 uH, 1 amp	TK4355	2.68
LED1	Green LED	P303	0.18
LED2	Red LED	P300	0.25
Q1	Transistor, 2N2222A	PN2222A	0.19
Q2	Transistor, 2N2907A	PN2907A	0.19
Q3	Transistor, P enhancement FET, Rds = 0.3 ohms	IRF9530	2.40
R1	Resistor, 200 1/4W	200Q	0.05
R2	Resistor 470 1/4W	470Q	0.05
R3	Resistor, 2k 1/4W	2KQ	0.05
R4	Resistor, 48.7k 1/4W 1%	48.7KX	0.11
R5	Resistor, 1.5k 1/4W	1.5KQ	0.05
R6	Resistor, as required for IC	1.0Q	0.05
HDR0-HDR3	Header, 6-pin	S2012-06-ND	1.11
JMPR0-JMPR3	Jumper for headers	S9000-ND	1.09
Socket	Socket for IC1	ED3316	0.83

Operating the Fast Charger is simple. Plug or switch the desired program input pins to match the cell count and the charging time requirement. Apply power to the Fast Charger circuit and install the batteries. Fast charging will begin, and the batteries are charged to the peak capacity when the fast charging cycle is completed. The batteries may be left attached to the Fast Charger for the batteries to receive a trickle charge. At the end of the fast charge, the batteries may feel warm, but they should not feel excessively hot (greater than 120 degrees Fahrenheit). If the batteries become hot, then the fast charge current is too excessive. Increasing the value of R6 will alleviate the problem.

I ran into the following problems: If Fast Charger draws excessive current, check Q1 and Q2, they may be swapped causing the excessive current draw; if Fast Charger will not go into trickle charge, verify C2 and C3 values.

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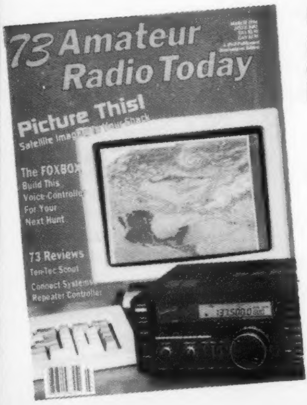
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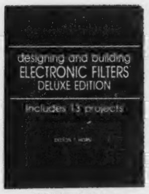
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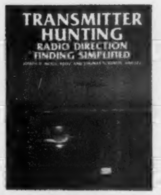
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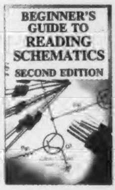
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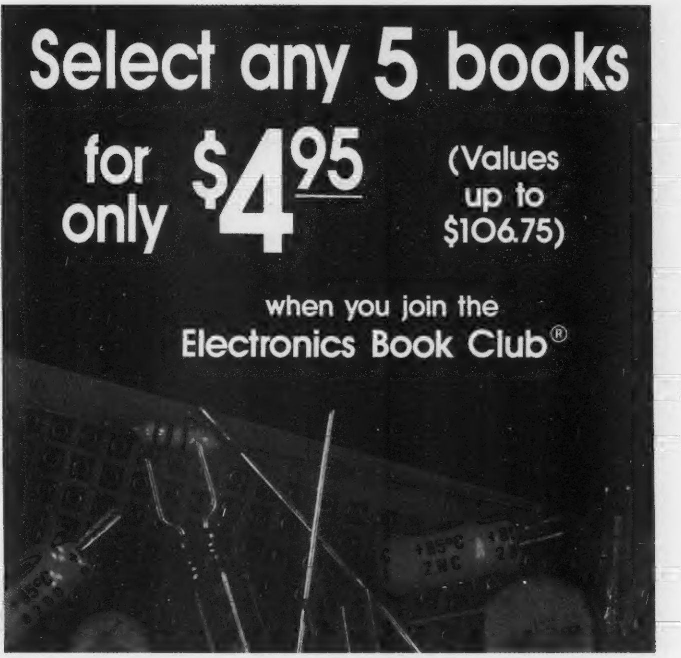

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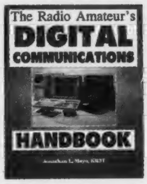
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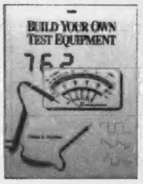
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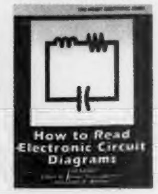
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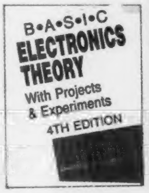
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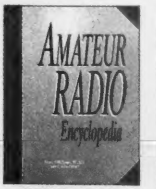
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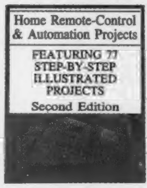
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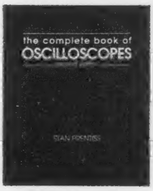
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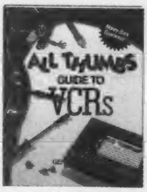
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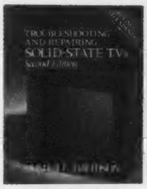
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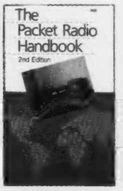
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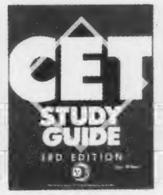
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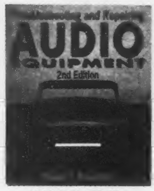
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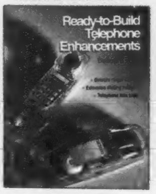
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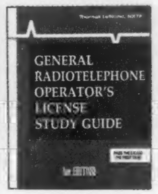
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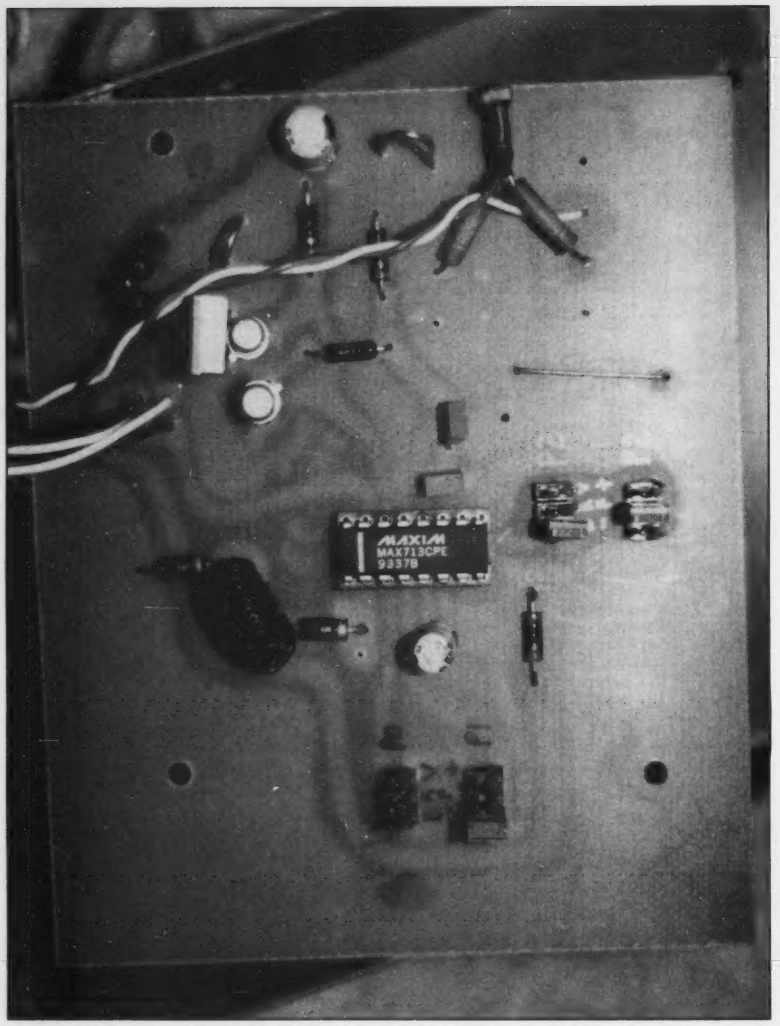

Photo A. A drilled and etched PC board for the Fast Charger is available from for $5 plus $1.50 S & H per order from Far Circuits, 18N640 Field Ct., Dundee, IL 60118..

All the parts used on this project are available from Digi-Key Corporation, (800) 344-4539.

Schematic

The schematic in Figure 1 shows the circuitry. The left side of the schematic shows the programming devices. Shorting jumpers, headers with jumper shorting blocks or switches can substituted for these devices. R6 is shown as two resistors. This allows custom values of non-standard resistance by using readily available standard resistance values and placing them in parallel.

Figure 3 shows the operating characteristics when recharging a battery. A four-cell 500 mA hour NiCd pack was subjected to the Fast Charger. The chart shows the battery output voltage verses time. The start of the plot is power applied to the Fast Charger. Battery voltage increases with charging and then peaks at about 60 minutes into the charge. The battery voltage peaks and then begins to fall. Fast Charger detects the drop in battery voltage and shuts off the fast charge current and enters trickle charge at approximately 65 minutes into the charge.

Figure 4 shows the same battery pack subjected to Fast Charger after the pack has been fully charged. Again the chart shows battery voltage versus time. Since the pack is fully charged, the battery voltage peaks quickly and then the output voltage begins to drop. After approximately five minutes and 30 seconds into the charge, Fast Charge detects the drop in battery output voltage and changes from fast charging to trickle charging.

I hope that Fast Charger recharges your batteries as easily, quickly and automatically as it does mine. Fast Charger allows convenient quick charging of virtually any battery pack on the market.

I would like to thank Jim Keller KD6JWO for setting up and programming the HP Chart Recorder used for Figures 3 and 4, and for building the first "production" unit. ■

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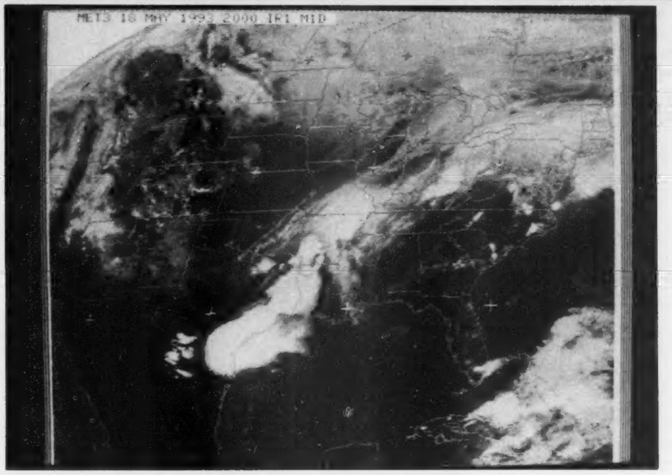

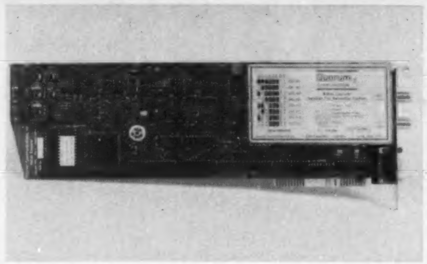

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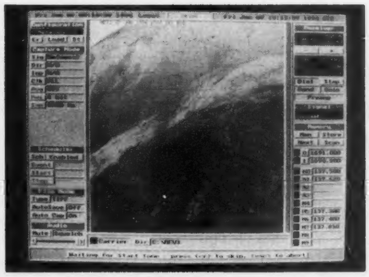

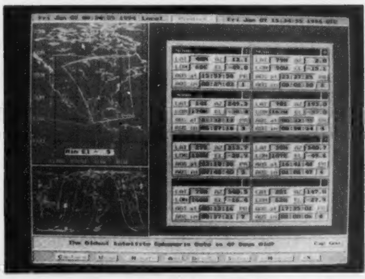

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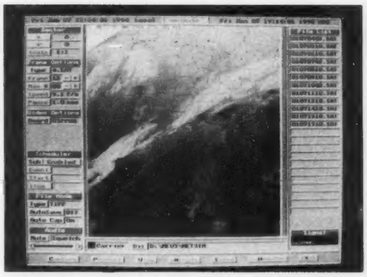

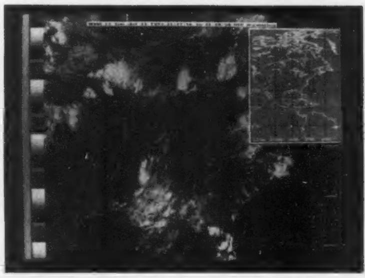

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The Radar Gun Reality

Ham scientist testifies on electromagnetic radiation.

Introduction by Wayne Green W2NSD/1

[You've probably been reading the same media twiddle about the dangers of cellular telephones and radar guns I have. And by extension, a danger from our HTs. You've been reading that there are conflicting data on these dangers. You've been reading tripe.

We are most fortunate to have Ross Adey K6UI... one of ours... as the world expert in this controversial field. Ross has been researching the effects of electromagnetic waves from DC up through the microwaves. He's been doing this for years. On the off chance that you may be interested in reading one of his reports, I'm going to reprint his testimony to the Ad Hoc Subcommittee on Consumer and Environmental Affairs of the United States Senate Committee on Governmental Affairs, Senator Joseph Lieberman, Chairman. His testimony was given for a "Hearing on health risks posed by radar guns; the extent of federal research and regulatory development of microwave emissions from hand-held radar guns."

Got all that?

The testimony was given August 7, 1992, by W. Ross Adey, M.D., of the Pettis Memorial VA Medical Center, Loma Linda, California.

Now, if you have some difficulty in reading this technical testimony, just imagine how little our average senator got from it... if it was even read, which is unlikely. Few of our senators have any technical background, so all this is gibberish to most of them.

If you ever get in touch with your senator you might ask him about the danger of radar guns and see what he says. It's good for a laugh anyway... Wayne]

1. Introduction

Mr. Chairman, thank you for this opportunity to appear before the Committee. I am William Ross Adey, and my testimony is presented as a private citizen. Since 1977, I have served as Associate Chief of Staff for Research and Development at the Pettis Memorial VA Medical Center at Loma Linda, California. I am a Distinguished Professor of Medicine (Neurology) at the affiliated Loma Linda University School of Medicine. My activities relevant to this hearing include founding membership in the Biomedical Commission of the International Union of Radio Sciences, with authority in the USA vested in the National Academy of Sciences; and as a consultant to the World Health Organization in health problems of nonionizing electromagnetic radiation. I am an elected Fellow of the Institute of Electrical and Electronics Engineers. From 1957-1977, I was a faculty member at the UCLA School of Medicine and Director of the Space Biology Laboratory of the UCLA Brain Research Institute.

For the past 46 years, my research career has covered a broad spectrum in neurology and the brain sciences, in environmental medicine, in biomedical and communication engineering, and in cell biology of molecular and atomic processes by which cells of brain and body tissues communicate with one another.

These latter processes have been the exclusive focus of our team's research for almost 20 years. We have played a pioneering role in understanding how body cells "whisper" to one another; and in so doing, we have discovered some of the keys to understanding how electromagnetic fields, so weak that some scientists have regarded them as incapable of biological effects, are detected by living tissues. We have studied some of the likely consequences for human health.

The problem of exposure of a restricted segment of the population to radar guns is but an example of the enormous and ever-growing use of systems and devices in our society that emit a vastly complex range of electromagnetic fields. The ubiquitous use of electricity makes it a factor of great and serious import in shaping the future of our society. For the individual, these same concerns are likely to touch all our lives in very personal ways.

2. Natural and man-made fields in our electromagnetic environment.

In any discussion of biological and biomedical effects of electromagnetic fields, it is necessary to understand that these fields are *oscil-*

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Police radar guns are not always hand-held. Instead, many are mounted onto the dashboard, still in close proximity to the officer. Photos by Charles Warrington WA1RZW; courtesy of Greenfield, NH, Police Department.

lating, meaning that they are waves that move through the universe, surging with a succession of peaks and troughs past an observer. These natural waves cover a vast *spectrum*, or range of frequencies. Just as in the piano where there is a range of frequencies covering many octaves from the low notes to the high, so also this electromagnetic spectrum covers many octaves. They range from very short waves with high frequencies to long waves at low frequencies; but they all travel at the same speed, 186,000 miles (or 300,000 kilometers) per second.

Amongst the very long waves are those oscillating at the power line *frequency* of 60 cycles per second, or 60 Hz. Their peaks are 5 million meters, or about 3,000 miles apart. As these waves become shorter, we enter the radio spectrum, where an AM broadcast station emitting waves at 1 million cycles/sec (1000 kilohertz [kHz] or 1.0 megahertz [MHz]) sends waves with a length of 300 meters. The microwave region of the spectrum begins by definition at a frequency of 300 million waves per second (300 MHz, waves 1 meter long) and extends by definition to 300 billion waves per second, or 300 gigahertz (GHz). At 300 GHz, the waves are only one twenty-fifth of an inch, or 1.0 millimeter long. Police radar guns operating at 10 GHz (X-band) and 24 GHZ (K-band) have wavelengths of 30 millimeters and 13 millimeters respectively (1.2 and 0.5 inches).

But this is by no means the limit of the electromagnetic spectrum. It extends many octaves beyond the millimeter wave band, with ever shortening wavelengths and ever higher frequencies of oscillation. Millimeter waves are succeeded by the infrared spectrum, and this in turn by the spectrum of visible light, covering barely an octave as wavelengths shorten from red to blue. From the visible region of the spectrum, there is a progression through the ultraviolet, to X-rays and ultimately to the very short cosmic rays from outer space.

In a biological perspective, all life on earth has evolved in a sea of low-frequency electromagnetic fields, generated in part from the sun and also from the huge energy of thunderstorm belts in the Amazon basin and in central Africa. In an historical perspective, this natural electromagnetic environment has been vastly perturbed since the beginning of the 20th century by an ever-increasing level of artificial electromagnetic fields.

These artificial fields now bathe us throughout our lives, in our homes, in the workplace, and in the environment. In two important ways, they differ from the natural electromagnetic environment. Firstly, they are typically hundreds and in some cases millions of times stronger than the natural fields. Secondly, and most importantly in this hearing on possible health effects of weak microwave exposure, most energy of the natural fields occurs at frequencies below 100 cycles per second (100 Hz). That is, they surge back and forth less than 100 times per second as *oscillating* fields. Natural sources, such as the sun, produce only small amounts of high-frequency energy in the radio and microwave regions of the electromagnetic spectrum.

In contrast, man-made devices and systems now expose us all to an electromagnetic environment of almost unbelievable complexity from conception to death. In addition to low-frequency fields associated with electric power distribution systems and the devices and systems operating directly from the power system, most urban and suburban environments also involve exposures to radio frequency and microwave fields. Obviously, the magnitude of these exposures depends on proximity to the sources; whether, for example, near industrial radio frequency heating systems for plastic molding and sealing plastic surfaces; or to radio, TV and microwave transmitters widely scattered in most urban and suburban environments; or in the use of hand-held portable transceivers placed close to the head of the user; or in microwave radar sources close to body parts, as with police radar guns placed in the groin in an operating condition.

3. The scope of federal research on microwave emissions.

With such a vast range of frequencies in the electromagnetic spectrum, it is inevitable that

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to date only scattered segments have been explored for their biological interactions. Biological and biomedical research has been restricted by limitations on funding. This has come mainly from Federal agencies seeking early answers to specific problems in mission oriented research. National fashions in research have emerged in consequence. Thus, public and congressional preoccupation over the past decade with possible hazards of 60 Hz electric power sources has made it essentially the sole facet of nonionizing electromagnetic field research supported by federal civilian agencies.

Until recently, when the National Institute of Environmental Health Sciences manifested a renewed interest, the US Department of Energy has been the sole custodian of a Federal civilian research program in nonionizing radiation since 1986. At that time, the US Environmental Protection Agency eliminated its active and highly regarded program.

Even with a strong focus on 60 Hz bioeffects, to the exclusion of other urgent problems, a total DOE budget of less than $5 million has been seriously inadequate in the search for needed knowledge of the mechanisms underlying weak EM field interactions with living tissues. For more than ten years, there has been virtually no federal civilian funding or medical research on effects of radio frequency or microwave fields.

Within the Department of Defense, the US Air Force has assumed the role of Lead Agency in microwave research. US Air Force studies deal exclusively with effects of high level exposures, with effects attributable to tissue heating. As a matter of policy, the Air Force denies existence of biological effects attributable to *athermal* fields (Erwin, 1988). Nevertheless, evidence for athermal bioeffects is incontrovertible for both low-frequency and radio frequency exposures, and tissue heating is not the basis of these interactions. All exposures of law enforcement personnel to radar guns are athermal, so that if there are biological consequences, models and mechanisms to explain these interactions cannot be based on heating models that are the essence of ANSI/IEEE guidelines. I shall return to these issues in greater detail, including the regulatory aspects.

3a. *Research on biological and biomedical effects of microwave fields.*

My principal purpose is to review the scope and content of research relevant to possible health hazards of microwave emissions from traffic radar guns.

It is important to first address the question of what our expectations might be from research on devices or systems viewed as potential environmental health hazards. It is the premise of protagonists of police radar guns that there is no significant risk from these microwave exposures. To the contrary, their documentation may be generously interpreted as only showing that, at best, there is no proven hazard.

Although limited in scope by totally inadequate funding from either federal or other sources over the past decade, research in the USA and elsewhere on bioeffects of athermal RF/microwave exposures has contributed strong indicators that the possibly hazardous nature of these exposures must be seriously considered.

Two major streams of new knowledge have emerged. On the one hand, *epidemiology* studies have addressed human diseases that now appear ever more closely related to environmental electromagnetic field exposure. On the other, laboratory studies in cells, tissues and animal models have disclosed in considerable detail many of the *fundamental mechanisms* by which extremely weak electromagnetic fields interact with cells and tissues.

As I pointed out at a related hearing by the Subcommittee on Natural Resources of the House Committee on Science, Space and Technology (7/25/90), it is important to emphasize that these studies at the cell and molecular level have built, and continue to build, a series of critically important bridges between laboratory science and human epidemiology; so that it is no longer possible to say that mechanisms mediating interactions of electromagnetic fields with biomolecular systems remain unknown with respect to potential health problems.

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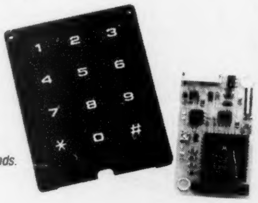

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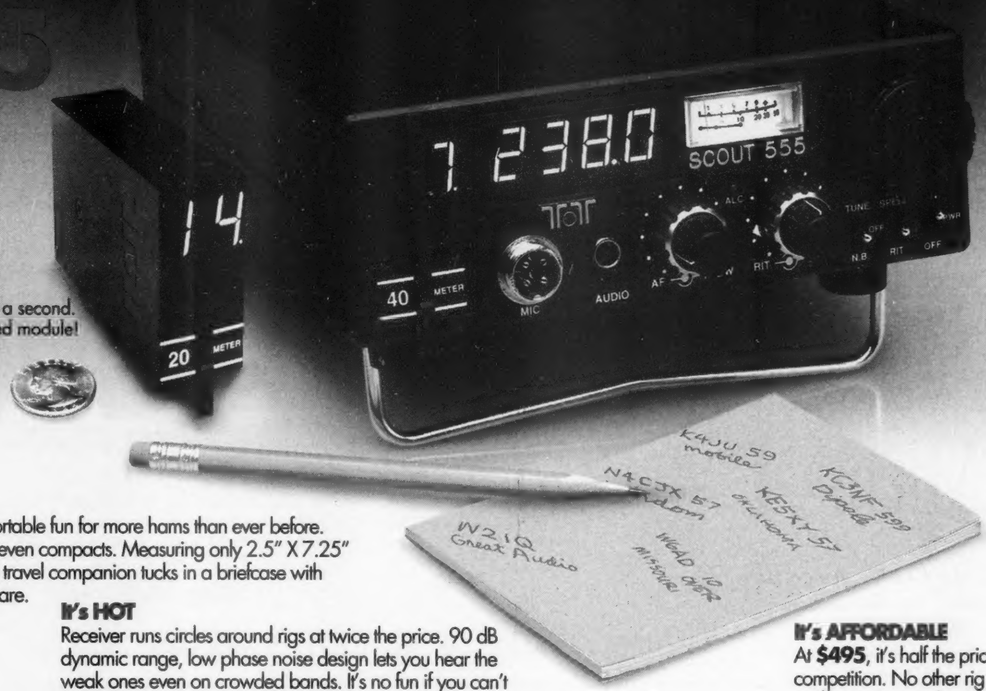

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In many respects, studies of mechanisms provide essential signposts and directives that will determine the very nature of further epidemiology studies. For example, laboratory studies have revealed enhanced effects of chemical cancer promoters in joint actions with electromagnetic fields; thus, the epidemiological hunt for the basis of increased cancer risk now invites detailed consideration of possible joint effects of environmental chemical pollutants and electromagnetic fields. For operators of police radar guns, for example, there is the question of long-term concurrent exposure to automobile exhaust fumes as a possible adjuvant factor.

4. Health-related effects of athermal RF/microwave fields; laboratory studies in cells and tissues.

ANSI/IEEE guidelines consider tissue heating as the sole premise on which to base safety standards, precluding from any consideration the very existence of athermal interactions. It is therefore imperative to identify by specific citations some of the findings in much weaker athermal exposures that may bear, directly or by extrapolation, on potential human health hazards.

The following account describes RF/microwave field effects at athermal exposure levels, substantially below limits permitted under ANSI/IEEE guidelines. Virtually all have received some form of federal support.

Most laboratory tests with RF/microwave fields at frequencies below 1000 megahertz (1.0 gigahertz) have reported effects of *low-frequency modulation*, or periodic interruption, of the high-frequency carrier wave. If a long-range radar transmitter is used (not a police radar gun), the signal is typically "pulsed" at frequencies from 5 to 1000 pulses per second; or the signal may be rhythmically modulated with a sine-wave signal, typically at frequencies below 100 Hz. At carrier wave frequencies below 1000 MHz, bioeffects have been reported with *unmodulated* carrier waves only with fields sufficiently intense to cause tissue heating.

4a. *Summary of major effects of modulated RF/microwave fields.*

A gamut of effects has been reported, most confirmed in independent studies in different laboratories. They relate to a hierarchy in the ordering of biological systems.

i) *Modification of calcium binding* at cell surfaces has been a pivotal observation, confirmed in many studies (Bawin et al., 1975; Blackman et al., 1979, 1985; Dutta et al., 1984; Lin-Liu and Adey, 1982). Calcium is the key messenger, carrying messages (from hormones, antibodies, neurotransmitters and chemical cancer promoters) from cell surfaces to the interior. Calcium also mediates signals between cells that prevent unregulated cell growth and tumor formation.

ii) *Actions on cells of the immune system.* The body's immune system is the fortress built by nature against infection and the creeping claws of cancer. Reduced immune competence is therefore followed by dire consequences for the individual, whether it results from aging, from the ravages of infections such as AIDS, or from environmental chemical pollution. *Lymphocytes* of the immune system can be "targeted" against tumor cells, destroying them by breaking their covering membranes.

A malignant tumor of the lymph glands of the groin (*malignant lymphoma*) has been reported in users of police radar guns. In studies with cell cultures, athermal microwave fields (450 MHz, 1.5 mW/cm²) with 60 Hz modulation reduced by about 20 percent the killing capacity (*cytotoxicity*) of lymphocytes targeted against human lymphoma cells (Lyle et al., 1983). Unmodulated 450 MHz fields had no effect. These fields also disrupted by up to 60 percent activity of enzymes that act as internal messengers inside lymphocytes, including messages regulating cell growth (Byus et al., 1984).

iii) *Modification of enzyme activity regulating cell growth.* A series of studies in different laboratories have reported sensitivities to modulated RF/microwave fields of growth-regulating enzymes located within widely differing types of mammalian cells (Byus et al., 1984, 1988; Krause et al. 1990). In confirmation of the athermal character of these interac-

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tions, they have been shown to depend on the presence of low-frequency modulation, rather than simply on field intensity; and more specifically, to relate to a narrow band of modulation frequencies in a fashion described as a *frequency window*. These phenomena are quite inconsistent with thermal models.

iv) DNA synthesis in cultured mammalian cells following exposure to increasing microwave fields at constant temperature. Cultured human blood lymphocytes and human brain cells can be exposed to increasing levels of 2.45 MHz CW microwaves, but maintained at their normal 37 degree Centigrade environment. Under these conditions, they synthesize DNA with a sharp peak in the response in a narrow range of field intensities (Cleary et al., 1989). This is an *intensity window*, also quite inconsistent with thermal models of interaction.

4b. *The millimeter wave region: bioeffects of fields similar to those in police radar guns.*

Police radar guns operate with a continuous wave (CW) signal at either X-band (10 GHz) or K-band (24 GHz). Their frequencies are high enough to resonate directly with the vibrations of biological molecules or portions of these molecules. These direct molecular interactions do not occur at lower frequencies.

Biomolecular and cell research in this spectral region has been meager. Studies in solutions of DNA and of growth effects in bacteria have yielded conflicting results that may relate to extreme technical difficulties not encountered at lower frequencies. There are major problems in the engineering of suitable exposure systems, in ensuring biocompatible exposure devices, and in evaluation of experimental data for physical and biological artifacts.

4b.1. *Cell growth responses to millimeter wave exposures.* These studies may have special significance. They have opened new doors to understanding mechanisms that underlie bioeffects of extremely weak millimeter wave fields. The definitive findings are the product of a single team of highly competent German scientists, collaborating for the past 15 years within the framework of the prestigious national Max Planck organization (Grundler et al., 1977; Grundler and Keilmann, 1978).

Their work has examined effects of millimeter wave fields on growth of yeast cells, a cell type commonly used in biological and biomedical research concerned with cell growth and genetic mechanisms. We are concerned here with *process*, with mechanisms at a level so fundamental in living systems that they are found in most, if not all, cellular organisms. By extrapolation, these studies raise questions about the possibility of comparable effects in human tissues exposed to fields of the type produced by police radar guns. At the same time, it must be emphasized that only with much further research can we determine the validity of this interpretation.

In the first studies by the German team, yeast cell cultures were irradiated with continuous wave millimeter fields at field intensities of a few milliwatts/cm². The growth rate was considerably enhanced or reduced depending on the field frequency around 42 GHz, with a succession of peaks and troughs at intervals of about 10 MHz. In agreement with our earlier analogy with a piano, the cells' growth response appeared finely *tuned* to the frequency of the applied field. Careful temperature monitoring excluded a trivial thermal origin for this effect. Repetition of this experiment confirmed that yeast culture growth is indeed affected by weak microwave radiation in a frequency-selective manner (Grundler et al., 1983; Grundler and Keilmann, 1983).

These early experiments have been substantially improved and extended (Grundler, 1990). Growth of single yeast cells has been measured microscopically, and orientation of each cell controlled with respect to the imposed field (Grundler and Kaiser, 1992).

A notable finding in these recent studies is that the sharpness of the tuning increased as the intensity of the imposed fields decreased; but the tuning peak occurred at exactly the same frequency as the field intensity was progressively reduced. Moreover, clear responses occurred at incident field levels of 5 picowatts/cm², about one million times below field levels permitted under ANSI/IEEE

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guidelines for millimeter wave exposure.

What do these studies suggest about a threshold, or lower limit for sensitivities to these weak fields? Theoretical and experimental modeling has gone hand in hand with biological studies. New conclusions are striking, even challenging, with respect to potential health hazards. Professor Friedemann Kaiser, a theoretical physicist with the Max Planck organization and a world authority on weak millimeter wave interactions (Kaiser, 1983, 1988), concludes that, in interactions between an imposed field and an oscillator within a cell, ". . . imposed fields can be active even at intensities near zero" (Grundler and Kaiser, 1992). In other words, a lower limit or threshold would not exist.

Research at the other extreme in the electromagnetic spectrum with 50 and 60 Hz electric power fields also support this concept. Theoretical and experimental studies at the University of Oxford by McLauchlan (1992) conclude that sensitivities in biomolecular systems may exist even at the lowest levels of magnetic energy input. Based on interactions between magnetic fields and chemical forms known as "free radicals" there can be "an enormous effect of a small magnetic field on a chemical reaction, and the effect begins at the lowest applied field strength."

5. Physical and engineering aspects of operator exposure to radar gun exposures.

If extremely weak millimeter wave fields can interfere with mechanisms regulating cell growth, are radar gun operators exposed in ways that might pose risks?

5a. *What field intensities exist at the aperture of radar guns?*

Many thousands of measurements have been made by Fisher (1991) in the period 1982-1991. For X-band (10 GHz) models popular in the early 1980s, the average antenna aperture power density was 3.36 mW/cm^2 for fixed-mount devices, and 2.66 mW/cm^2 for hand-held devices. With later development of K-band (24 GHz) technology, the average aperture power density dropped to 0.93 mW/cm^2 for fixed-mounted systems and 0.69 mW/cm^2 for hand-helds.

These incident field levels are approximately one million times higher than incident fields changing growth of cells by direct exposure.

5b. *Are there circumstances in which all or most of this energy would reach the surface of the body?*

Fisher's (1991) extensive evaluation of microwave exposures encountered by traffic radar operators states that with hand-held devices, "when it is placed in the operator's lap, 100% of the aperture power density would be incident upon portions of the radar operator's body that are in contact with the antenna's aperture. Radar operators who place the hand-held device in their laps or inadvertently point the antenna towards themselves will find themselves in the HPD (High Power-Density) region of the antenna, with exposure to more than 1.0% of the aperture power density."

5c. *Will most of this energy enter the body or will it be reflected from the skin?*

As discussed in the next Section, relatively little reflection of millimeter waves occurs at the body surface. Most field energy penetrates the body surface and is absorbed by body tissues.

5d. *If the field enters the body, how deeply will it penetrate before dropping to levels less than those shown to alter cell growth?*

Millimeter waves are rapidly attenuated as they penetrate the body surface. This rapid weakening of the field is due to energy absorption by water molecules. In engineering terms, this attenuation is measured at 17-20 decibels/millimeter. In more familiar terms, as little as 1.0 percent of the field energy at the body surface will be found 1.0 millimeter below the surface; and at a depth of 3 millimeters (one-eighth of an inch), the field intensity will be one-millionth of that at the surface.

How do these physical properties of the body determine the actual tissue field levels from operating radar guns in close contact with the body surface? It appears a reasonable conclusion that for antenna aperture densities of 1-3 milliwatts/cm^2, fields at picowatt levels will be found at depths of 3 millimeters; and as noted above, there is evidence that millimeter wave fields at this intensity can modify cell growth.

5e. *Are organs such as the testis or lymph glands in the groin close enough to the body surface to be exposed to significant field levels?*

I now wear the hat of an anatomist with more than 30 years' experience in teaching and research in the anatomy of the human body in the Australian medical schools of the Universities of Adelaide and Melbourne, in the University of Oxford, and at the University of California at Los Angeles.

As *Gray's Anatomy* points out, "The skin of the testis is extremely thin." It is devoid of fat, so that the scrotal contents may be transilluminated with a flashlight. In consequence, the testis itself has a very narrow separation from the skin surface, typically not exceeding 2 millimeters. Thus, picowatt level fields may be anticipated in the outer zones of the testis from incident fields on the skin surface in the low milliwatt range.

A similar situation pertains for the lymph glands of the superficial inguinal group in the fold of the groin. Malignant lymphoma has been reported in lymph glands in this region in association with exposure to police radar guns. By reason of the arrangement of major ligaments and fascial sheets in this region, these lymph glands lie close to the overlying skin, with minimal amounts of fat separating them.

6. Epidemiology of human microwave exposure.

For the millimeter wave spectrum, there have been no epidemiological studies. For other parts of the microwave spectrum, some findings in limited studies may be relevant by extrapolation to millimeter wave exposures.

Szmigielski et al. (1988) examined cancer incidence amongst Polish career military personnel. The major exposure was to radar microwave fields, but exposures to 50 Hz power fields were also involved. Differences in cancer rates between exposed and unexposed subjects were large, with rates generally six times higher in exposed than in unexposed subjects. Most malignancies were reported as lymphomas and leukemias.

Yugoslav microwave workers have shown abnormalities in blood lymphocyte chromosomes (Garaj-Vrhovac et al., 1990) in studies that compared these findings with similar, more severe changes in vinyl chloride workers. Exposures were of long duration (8 to 25 years, mean 15 years). Microwave power densities at the work sites were in the range 10 to 50 microwatts/cm^2, or approximately 1 percent of levels permitted under ANSI/IEEE guidelines. These same researchers produced similar chromosome abnormalities in mammalian cell cultures exposed briefly (15, 30 and 60 min) to a 7.7 GHz field at an intensity of only 0.5 mW/cm^2, or one-twentieth of levels permitted in the revised ANSI/IEEE guideline.

The long exposures experienced by these Yugoslav workers raises questions about possible effects of *cumulative* dose, a factor also raised in case reports of police radar gun operators. This problem was addressed directly in studies of brain tumor incidence in RF/microwave workers by the National Cancer Institute (Thomas et al., 1987). Microwave workers were grouped by length of exposure in 5-year cohorts. No measurements of field exposures were available. Incidence of malignant brain tumors (astrocytomas) was progressive with length of exposure. For those in excess of 20 years, the risk was 10 times control levels, if they were simultaneously exposed to microwaves and soldering fumes, electronic solvents and a variety of other chemicals. All the excess risk was for those engaged in design, manufacture, repair and installation of electrical or electronic equipment, suggesting joint actions of chemical factors and RF/microwave fields, as already discussed.

7. Regulatory considerations: the ANSI/IEEE guidelines.

The results of much research presented here leave little doubt about the reality of athermal bioeffects of RF/microwave fields and their importance with respect to potential human health hazards. Nonetheless, this knowledge has yet to take its place in any safety guidelines. Those private bodies presuming to advise government, industry and the general public have produced guidelines based solely on tissue heating thresholds.

In the absence of federal regulations relating to any environmental electromagnetic field exposure, limits promulgated as "guidelines" by the American National Standards Institute (ANSI) became the *de facto* standards for occupational and non-occupational exposure in 1982 (ANSI Standard C95.1-1982, covering the spectrum from 300 kHz to 100 GHz). Subsequent revisions of the ANSI C95.1-1982 Standard, now known as IEEE

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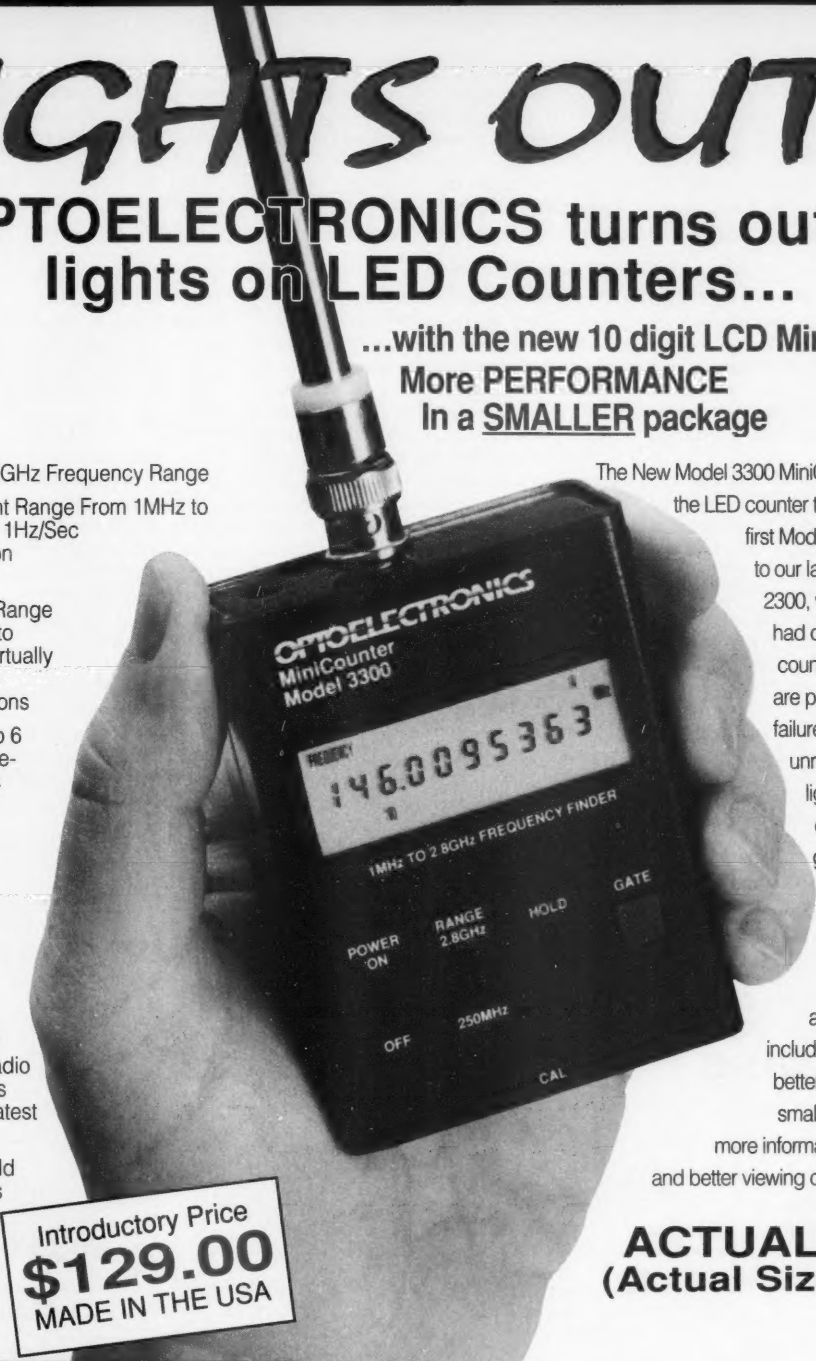

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C95.1-1991, were undertaken in behalf of ANSI by Subcommittee 28 of the IEEE Standards Coordinating Committee (SCC28).

By uncompromising adherence to thermalizing levels of exposure (10 mW/cm²) at frequencies above 1.5 GHz as the sole basis for human health concerns, the new ANSI/IEEE guidelines raise questions of objectivity in reviewing available evidence. There has been a willful refusal to consider the significant volume of highly credible scientific evidence on athermal effects, dismissed by the co-chair of Subcommittee SCC28, Dr. Eleanor Adair (1990), as "today's grab bag of contradictory or unreplicated evidence and miscellaneous theory, falling far short of credibility."

Worse, the ANSI/IEEE guidelines appear to have become a refuge for special interests for whom the very existence of health problems at athermal levels of exposure would have important consequences. For example, Fisher (1991) in his engineering review of microwave exposure levels encountered by police traffic radar operators concludes that "with a high degree of certainty, microwave exposure levels encountered by these operators is less than 1% of the maximum exposure level of 5 mW/cm² established in ANSI standard C95.1-1982. Because of this (sic) standards and the results of this experimental research, we are able to conclude with a high degree of certainty that there is no evidence to support the allegation that police traffic radar operators are at risk due to prolonged exposure to microwave emissions from their radar units."

Thus are uninformed engineering opinions on some of the most complex of medical problems foisted on an unsuspecting public.

8. Recommendations.

1. As an emergent general conclusion, it appears that cognate Federal regulatory agencies should assume direct responsibility for development and implementation of urgently needed safety guidelines for RF/microwave exposures. This had been a long-standing requirement, made more urgent if a national patchwork of separate state and local enactments is to be avoided. These tasks should not be left in the hands of private bodies, all too often susceptible to pressures of special interest groups.

2. Future developments in safety guidelines should encompass the highly credible body of information on athermal bioeffects, including effects of modulation patterns on RF/microwave fields, and growing evidence on biomolecular interactions with millimeter wave fields.

3. There is an urgent need for a national civilian research program on medical effects of RF/microwave exposures. This program should encompass both epidemiological and laboratory studies, with special emphasis on industrial and military exposures. This research initiative should recognize the importance of cooperative international efforts, particularly through mechanisms of the World Health Organization and related bodies, including the International Telecommunications Union and the International Union of Radio Sciences (URSI). It is pertinent that the German Government has recently developed a national program of fundamental bioelectromagnetic research through its prestigious Max Planck organization, with a strong focus on athermal millimeter wave interactions and acceptance of the physical principles enunciated in this testimony as a point of departure.

A Summary by Wayne

I hope Ross won't be irritated that I've edited out two full pages of references.

In case the language of Ross' testimony before the Senate was too obscure for you, what he said was that yes, police radar guns can cause cancer. And yes, cellular telephones can cause cancer, as can ham rigs, if you're not careful. This is the same stuff I've been telling you and has been resisted by some of our more obtuse brethren.

It does appear that a 2m HT probably won't cause much harm . . . unless you're running PL tones. Those are the real mischief makers.

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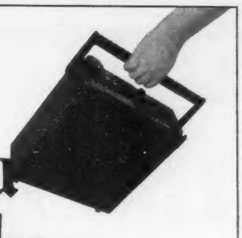

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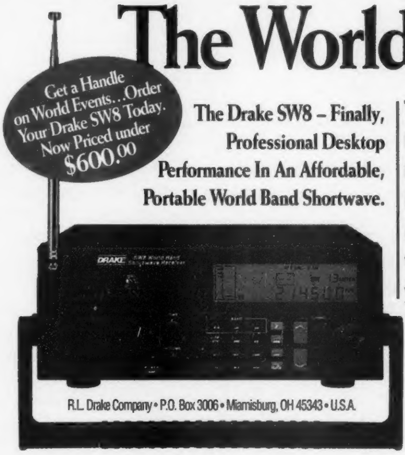

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73 Review

by Michael Jay Geier KB1UM

The ICOM IC-2iA Micro HT

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What's that? You say you want a walkie small enough to drop into your pocket or purse without so much as a bulge? Today's walkies just aren't small enough to take with you wherever you go? Well, check out ICOM's new IC-2iA. There's a whole new generation of ultra-small HTs coming around, and ICOM has led the pack with this miniaturized model. This tiny radio sports the emerging new style of slide-in battery which fits into the bottom of the case, keeping the size of the rig to a minimum. Where's the radio? I've seen *microphones* bigger than this thing. At only 2.3" x 3.6" x 1.2", this is as small as it gets! And even with the battery pack installed, the whole shebang weighs only a little over nine ounces. With rigs this size, there's just no excuse for leaving them home.

Basics

This radio represents a new approach to HT operation. Rather than the usual array of buttons, this one has only seven of them to operate all the advanced functions we've come to expect in today's walkies. Plus, of course, the squelch, volume and rotary dial knobs are on top, just as with any HT. That's it! No DTMF keypad. My first reaction was, "Oh, no autopatch calls with this thing." I was wrong—you can program in up to 16 autodial memories and send them whenever you like. So how do you control all that stuff with only seven buttons? ICOM has developed what they refer to as "artificial intelligence" modes. Essentially, they're menus which let you set up all the parameters. The AI twist refers to your ability to lock yourself out of what you don't feel ready to use. In fact, there's one mode in which the various features begin to appear gradually as you accumulate hours using the radio. As a seasoned ham, it's hard for me to judge the usefulness of such an approach, but, to a newcomer, it might be handy in avoiding confusion while learning gradually.

> ***"There's a whole new generation of ultra-small HTs coming around, and ICOM has led the pack with this miniaturized model."***

For such a tiny box, this radio does a lot. It transmits from 140-150 MHz, and the wideband receiver covers 138-174 MHz, taking in a fair amount of the public service band action. CTCSS encode/decode and DTMF paging functions are built in. In the easy mode, you get only 10 memories, but there actually are 100 of them, and they appear when you switch to the full-featured setting. The transmitter puts out 1 watt with the supplied battery. (At 13.8 volts, you get 5 watts out.) A watt is plenty for local repeater use, and the lower power output greatly helps conserve the battery, but it's less than most HTs put out. No current rating is printed on the battery pack, but in a separate list of available options I discovered that the 7.2 volt battery is rated at 400 mAh. That's about two-thirds the current capacity of most HT packs but, then, this radio is only about one-half to two-thirds the size of the average HT! Considering the size of the package, 400 mAh is not at all bad. If it's not enough for you, though, you can buy bigger packs which give you longer operating time or higher RF output power. You also can get a holder for 6 AA cells, so you can be sure of having power at all times. Of course, any of these options will make the radio a bit longer, but it still will be pretty darned small.

The LCD is quite large and the frequency is easy to read. Some of the icons are fairly small, but the most important stuff, like the memory channel number, stands out well. The buttons themselves are made of rubberized material, and they feel good, with distinct tactile feedback when pressed. Above the PTT is the function button, which lets you use the other buttons for multiple operations. There's a two-color LED which turns green when the squelch is open and red when you're transmitting. On the right side is a rubber cover, under which are the mike, earphone and external power input jacks. Overall, the rig seems especially weatherproof, except for where the battery enters.

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which means you can use it on car power without a separate regulator. But don't think you're going to go down to Radio Shack and make up your own power cable, because ICOM has used a modified version of the coaxial jack I've never seen before. As far as I can tell, only their cord will fit. Also, unless you buy the quick-charger, you must charge the battery through this jack; there's no jack on the battery pack itself. This involves some inconvenience, as you can't use the rig while you're charging the battery, but it also has a point: The radio maintains the memories via an internal, rechargeable battery, which also gets charged when you charge the main battery. By the way, the backup battery will keep your data for about two months with no power applied, so it shouldn't be a problem unless you hardly ever use the rig.

The rubber duck antenna is one of the nicest I've ever seen. It's not much longer than the radio itself, which is a welcome change from some of the small rigs which have huge antennas. Also, this one's both thin and extremely flexible above the bottom inch and a half or so. A cool quacker. Also included are a hand strap, belt hook and, of course, a wall cube charger.

Getting Started

The IC-2iA jams virtually all the goodies, such as CTCSS, DTMF squelch and such, into this little box. As initially configured, you're locked out of most of the good stuff. At first, all you get are 10 memories and one VFO frequency. Nothing else—not even repeater offsets! This is because the radio's default state is something called "easy mode." Designed for rank beginners, easy mode just gives you the bare minimum for simplex operation. But, recognizing that nearly all VHF ham communications in the U.S. are via repeaters, ICOM explains, toward the end of the short manual, how to get into the full-featured mode long enough to pick an offset. They also tell you how to set a CTCSS tone frequency. Other than that, you are referred to a separate set of instructions called the "Tech Talk." I found no such Tech Talk with the review rig, so I called ICOM. Apparently, some early units were shipped without it, requiring you to get it through your dealer. They assured me, though, that current units all have the Tech Talk included.

The Tech Talk manuals are simple, well-written and illustrated instructions which show you how to use the various features available in the full-function mode. Now you can get to the 100 memories, set scan limits, scan type, power-on and power-off timers (the radio has a built-in clock), program phone numbers and autopatch codes (which include the A, B, C and D codes) into the autodialer, set up the DTMF code squelch options, change the battery saver interval, skip and hide memories, you name it. There are even settings for LCD contrast and turning off the green "receive" LED to save power.

The Menu Interface

Cramming all this stuff onto seven buttons was quite an achievement! The use of menus is a great help, and I suspect we'll see more walkies with this type of control. Basically, you hold the "S" button while turning the rotary dial knob and the radio steps through all the functions which are accessible with the menus. The sequences aren't hard to do, but keep the Tech Talk sheets handy until you memorize the most common sequences. Luckily, once you get everything into memory, it's a piece of cake to go to a memory channel and start talking.

The Modes

There are four modes:

1) Easy: You get 10 memories and a VFO frequency. That's it. But, if you've already set repeater offsets into those memories or the VFO from one of the advanced modes, they still work.

"The IC-2iA jams virtually all the goodies, such as CTCSS, DTMF squelch and such, into this little box."

2) "Growing-type" AI: At first, very few features appear. As you build up hours of use with the rig and perform the various operations you are given, you get more features.

3) "Select-type" AI: You get to pick which features you want to appear and which you don't. The functions are ordered into seven groups, each starting with a letter in the word "special." The display shows the letters of the selected groups. This could be handy if, for example, you never use DTMF squelch and would like its menus to go away, uncluttering the operation of the rig somewhat.

4) "All-type" AI: This is the full-function mode, and most users will want to leave it this way.

On the Air

Like most ICOM receivers, this one is quite sensitive, even well outside the ham band. Selectivity is fairly good; you can tell when you're 5 kHz off. (Some rigs are so wide you can't tell no matter how hard you try.) The case doesn't get very warm when transmitting with the 7.2 volt battery but, then, it shouldn't with a 1 watt transmitter. Still, transmit efficiency must be fairly decent or you'd feel it after a minute or so of key-down time.

The receive audio is a little tinny, but it's quite loud for such a small rig. In fact, it's significantly louder than my normal-sized HT, which is great for using the rig in the car. You might actually be able to hear this one at highway speeds.

The transmit audio is a different story. Every contact I made began with the other operator's saying something like, "Gee, your audio is pretty muffled. I can understand you, but it ain't great." I listened to it through my other walkie, and they weren't kidding. A call to ICOM confirmed that this model tends to be a bit bassy. Looking at the front panel, I could find no microphone hole! It turns out they use a channel in the plastic which picks up sound through the speaker holes and sends it to the mike. It seems to lose most of the higher frequencies.

At ICOM's suggestion, I even opened my rig to make sure the channel wasn't blocked by a stray bit of glue, but it was clear. They told me that some owners have drilled a little hole over the mike, giving it direct sonic access and dramatically improving the audio. If you decide to do this, I suggest you open the rig and remove the mike first, so you don't drill into it. You may not find it necessary, though. Even if you do sound a bit muffled, you certainly can be understood.

What I Liked

This thing is really small. With its nice, flexible antenna, it's easy to take it anywhere, even when you might leave a bigger radio home. Once all your data is programmed in, selecting memories and using them is easy. Setting a frequency into the VFO is fairly quick, too, despite the lack of direct keypad entry. The receive audio is nice and loud. Though not rich-sounding, it's very intelligible. Even with no keypad, you can send autopatch numbers.

What I Didn't Like

With something this new and different, it's reasonable to expect some bugs and problems. Here's what I found:

Despite the menu system, this radio is a bit harder to program than some other HTs. Controlling all those features with so few buttons was bound to make things messy. Without the large Tech Talk sheets by your side, you are bound to forget how to operate the more advanced functions. A wallet-sized cheat sheet is provided, but it covers only a few easy-mode functions. A complete one for the all-type AI mode would be very welcome.

Unlike on most HTs, there is no automatic repeater offset function. If you set a frequency into the VFO which requires a different offset direction than the previous one, you'll have to go to DUP mode to change the offset from + to - or vice versa, or even to select simplex.

Finally, you can't use the radio while the battery is charging, even if you have another battery pack or an AA cell holder, because the standard charger connects through the rig. It isn't clear from the illustrations whether you can put the supplied battery into the quick-charger without the radio; the drawing shows it going in while attached. With the bigger batteries, it appears you can, though.

Conclusion

The IC-2iA represents a bold move by ICOM to create a new generation of micro HTs. If you want a really small HT with all the features currently dreamed up, the IC-2iA just might fit your needs. You sure won't leave it home because it's too big to carry around!

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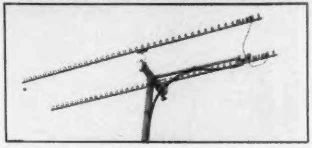

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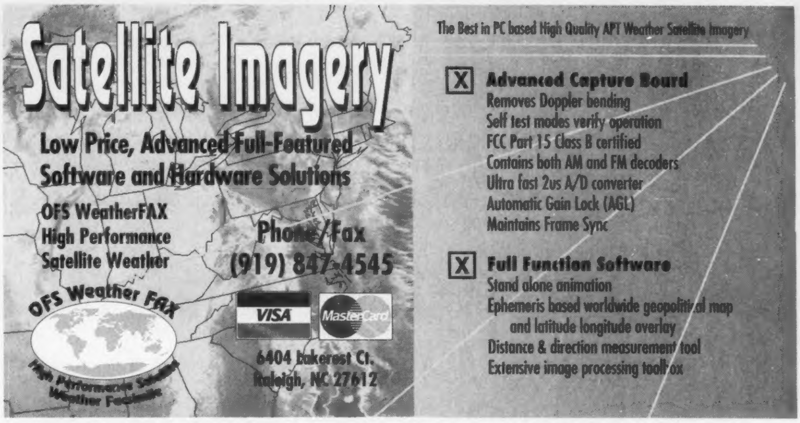

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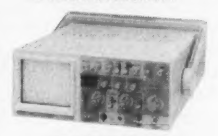

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The ICOM IC-737 HF All-Band Transceiver

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How many of you have ever wanted to upgrade your HF equipment but became confused by all of the features different manufacturers offer? Size and shape? Bells and whistles? Will it do this or that? Can I use it mobile? How forgiving is it to operate at a high SWR into the wet noodle antenna hanging out the window? And the final, ever-present question: *How much*?

Of course, there are many more questions we tend to ask when we are mortgaging the wife and kids to purchase that new HF rig and one of the biggest is: Is it worth it? Let's find out.

Any radio I get my hands makes me to wonder about many things: the ability to use the radio as my base rig or take it mobile; whether or not there's a built-in antenna tuner; the ability to operate SSB, CW, AM, FM, and RTTY/AMTOR/packet; ease of operation; number of memories; etc.

Thanks to being in the right place at the right time (in the *73* office when a big box from ICOM came in addressed to Associate Publisher David Cassidy N1GPH), I got a chance to use and review one of ICOM's latest and greatest pieces of HF equipment, the IC-737. I almost asked to borrow David's Outbacker mobile antenna to use it on the way home, but figured I might be pressing my luck a bit too much (a bird in the hand is worth two in the bush, etc.), so I had to wait until I got home.

My wife gave me that "not another toy" look as I brought the box into the house, but seemed a bit happier when I told her that I hadn't bought it but was reviewing it for *73*.

First Impressions

As I opened the box, I was pleased to see that ICOM packed the equipment as well as they did many years ago when I bought my last new radio. Enclosed was the radio (with carrying handle on the side, just like my IC-701), and inside another smaller box were the hand microphone, stereo plug (for CW operation), DC power cable, and two fuses (20A for the power cable and 4A for internal circuitry in the PA), and "Yes, Virginia, ICOM still fuses both the positive and negative power leads."

One of the first things I do when I see a new radio is look at the labels on the front panel to see if I can figure them out without having to open the instruction manual (heaven forbid). Of the 48 buttons and 11 knobs, I only had questions on the operation of five buttons. I don't think that's too bad for a new state-of-the-art radio.

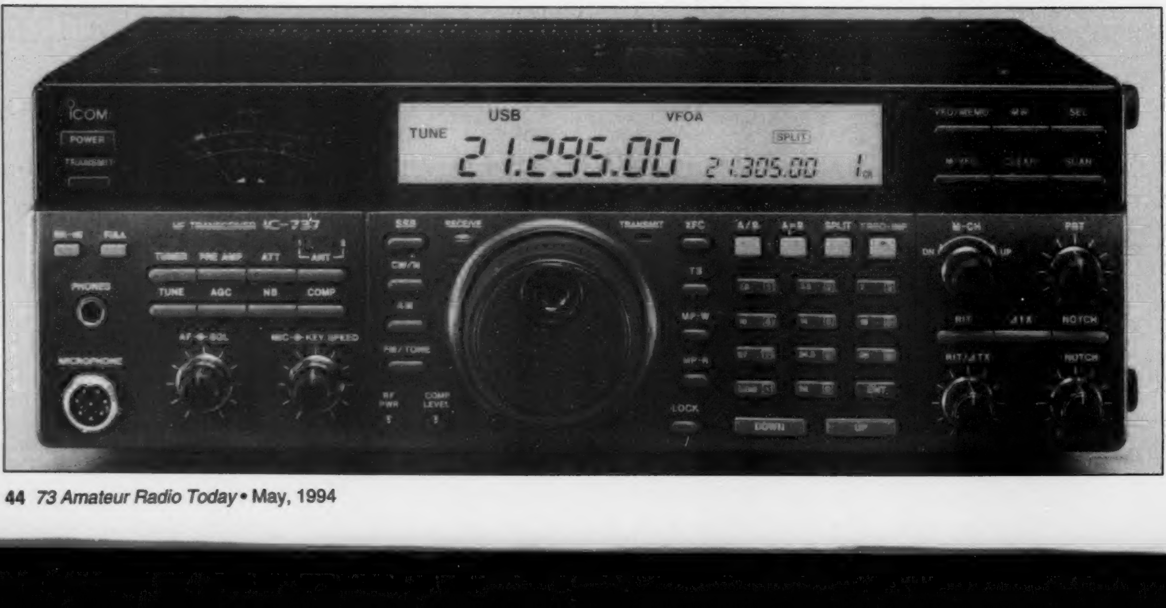
It didn't appear that those unknown buttons should stop me from firing up the IC-737, so I connected the hand mike, hooked the DC power cord to my 20A Astron, connected the DC cable to the back of the rig, and took my triband beam antenna coax from its switch box and started to screw it on the back of the rig. That's where I ran into a little problem: The IC-737 has two coax connectors on the back. What's up, Doc? Well, the ANT 2 receptacle had a plastic cover on it, so I hooked my beam up to ANT 1. That answered a question on one of unknown buttons on the front panel, a choice of Antenna 1 or 2. More on this later.

Power switch ON. No smoke, just normal sounds out of the speaker on the top of the radio. The frequency tuning knob in the front center had a nice free feel to it as I moved through the band. Volume control offered a nice range of audio and the outer knob squelch worked fine. Many operators have large fingers, but I think the size of the knobs will allow everyone to use them easily. The only two that might be a bit small are the RF PWR and COMP LEVEL, which don't get changed too much anyway—just set 'em and forget 'em at max smoke and mid-point.

Testing

Because I had moved out of my beam antenna's 2:1 area I figured I would test the internal antenna tuner's ability to bring my antenna back into range. I selected TUNER and was happy to see a small light in the button come on to show selection. I then touched

Continued on page 46



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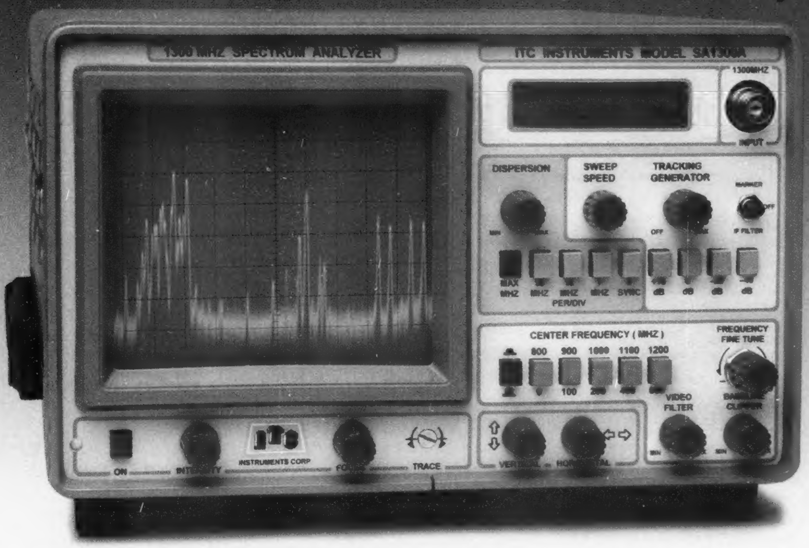
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The ICOM IC-737

Continued from page 44

the TUNE button, noticed needle movement on the combination S/RF meter, and watched the indications show tuning. As advertised (I peeked in the book for the times), in less than seven seconds, probably more like three seconds, it was tuned to 1:1. That's neat! I love it! Certainly faster than my trusty faithful old companion three-knob Dentron Super Tuner.

I decided to see what the rest of the bands would do, so I took a stab at UP and DOWN buttons to change bands. That worked also, but at 1 MHz steps. I also heard some whirring and figured that the automatic antenna tuner was making corrections on the fly, at least to get close. This isn't so bad, I thought.

Next was the use of the number buttons on the pad, listed as 1.8 (1), 3.5 (2), 7 (3), 10 (4), 14 (5), 18 (6), 21 (7), 24.5 (8), 28 (9), and 29 (0). Each button pushed took me to a frequency in that band and the proper mode. This radio is a piece of cake to operate!

The next button I tried was the FREQ-INP. I typed in the desired frequency on the number pad, pressed ENT, and there I was. This is too easy!

Since neither my IC-701 nor Atlas 210X have the WARC bands, I decided to hook up my 160m dipole to the ANT 2 connector and see what was happening. When I tried to select Antenna 2 on the front panel, nothing happened. Finally, I had run into something that forced me to open the Instruction Manual. After looking at all the pages about antennas listed in the index and not finding what to do, I started looking page-by-page. I finally found something called "set mode operation" that allowed changes in programming to be made in 13 different items, and one of those was activating the antenna switch. It was very simple, even for me. You can choose OFF (switch not activated), ON (switch activated for manual use), and AUT (switch activated and the band memory memorizes the selected antenna). This is too easy; my kind of radio! Of course, I selected AUTo.

As expected, once Antenna 2 was selected, the tuning worked great on all bands using my 160m dipole. This took a little longer on 10m (my Dentron can't get it below 1.6:1), but did fine.

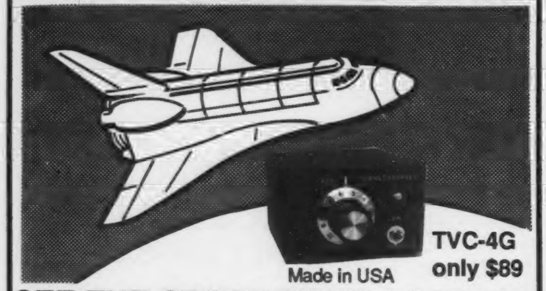
Most of the other buttons were self-explanatory: POWER, TRANS, BK-IN, FULL, PREAMP, ATT, AGC, NB, COMP RIT, TX, NOTCH, SSB, CW/N, AM, FM/TONE, LOCK, A/B, A=B, SPLIT. Many of these buttons have little lights in them to show selection. The knobs were also self-explanatory: AF, SQL, MIC, KEY SPEED, RF PWR, COMP LEVEL, RIT/TX, NOTCH, M-CH, PBT.

After attempting to memorize some frequencies into memories, I decided discretion was the better part of valor (I was beginning to look dumb, even to myself), so I looked in the very informative Instruction Manual again, and found that it's not really that hard (maybe I'm not so dumb after all). I just wasn't pushing the MW (Memory Write) long enough (one second). It's actually quite simple: 1. Set the desired frequency and operating mode in the VFO mode; 2. Rotate M-CH (Memory Channel) to select the desired memory channel to be programmed; 3. Push and hold MW for one second to program the displayed frequency and operating mode into the memory channel. To check the programmed contents, push VFO/MEMO to select the memory mode.

Channels 1-89 are regular memory channels with one frequency and one mode in each channel; channels 90-99 are split memory channels which allow independent transmit and receive frequencies and operating modes in each channel for split frequency operation (FM repeaters on 10m); and channels P1 and P2 are scan edge memory channels which allow one frequency and one mode in each memory channel as scan edges for programmed scan.

The IC-737 also allows for three different methods of frequency scanning: Programmed Scan repeatedly scans between two scan edge frequencies (P1 and P2); Memory Scan repeatedly scans ALL programmed memory channels; and Selected Memory Scan repeatedly scans all SELECTED memory channels.

AMATEUR TELEVISION



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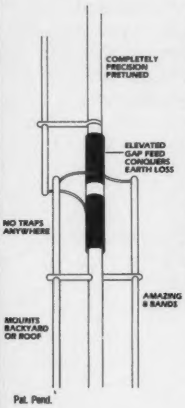
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UPDATES

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With regard to the above mentioned series which appeared in the January, February, and March 1994 issues, please note the following:

1. On all circuit boards, the transistor outlines inked on top of the boards for NPN transistors are not for the 2N2222 types. The author suggests using either the 2N3904 or 2N4123 types. The 2N2222s will work if you bend the base lead back between the other leads so they are mounted correctly.

2. For the 1 MHz oscillator (Part 3), if you have trouble getting enough output, add a 56k resistor from the base of Q8 to +8 volts. If the output is still inadequate, reduce the AGC by adding a 100k resistor across C11.

Getting Started With Satellite Imagery

In connection with the above mentioned article (March 1994, page 14), we listed a number of vendor addresses. Among these was the (former) address for Software Systems Consulting. Please contact SSC at their current address: Software Systems Consulting, 615 S. El Camino Real, San Clemente, CA 92672. 73

HAM HELP

Number 12 on your Feedback card

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WANTED: Donations, suggestions, new members. ATOM, Amateur Television of Manchester is a new group organizing to help educate, experiment, and increase local activity on ATV in New Hampshire and New England. *ATOM, 175 Crosbie St., Manchester NH 03104.*

WANTED: Manual (or copy) for ICOM IC-02AT 2 meter. I also need the operator's instruction manual (or copy) for YAESU FV 102DM VFO, and REALISTIC Comp-100P programmable memory scanning receiver. I will pay for the manual or copying fees. *Vincent Lopez NP4MZ, 60 Moore St. Apt. 5J, Brooklyn NY 11206.*

I would like to get in touch with anyone who knows how to modify the UNIDEN HR2600 for QRP operation. *Jim N9KXB, 5748 N. Campbell #3, Chicago IL 60659.*

I have liberated an HW-5400 transceiver from the clutches of a CB'r who had "modified" the 10 meter band. I need the HEATH construction manual with schematics on this unit in order to return it to Amateur status. Original, zerox, etc., ok. I will pay your costs, or buy if you want to sell. *John A. Callahan KR5K, 340 E Gaywood, Houston TX 77079. Tel. (713) 461-6704.* 73

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Actual Use

No review is worth its salt if nothing is said about the ability of the transmitter and receiver to do their parts. I do not have any test equipment, so I will leave it up to ICOM to be honest in its representation as shown in the Specifications sidebar. The proof is in the pudding, though, and the IC-737 talks with ICOM's usual fine audio quality, even under compression, and listens just fine. No surprises there. What I could hear, I could usually work, except in the pileups with the "Big Guns." The NOTCH and PBT (Pass Band Tuning) were certainly able to do their intended jobs.

Connectors

Another important part of any radio is its ability to support external devices, such as connecting to a linear amplifier, a TNC for data communications, etc. The IC-737's back panel is composed of the two antenna connectors, a ground bolt with a wing nut, a connector for an external speaker, an electronic keyer switch that turns the internal electronic keyer ON and OFF, a CW semi-break-in delay control, a CW key jack, two accessory sockets (7- and 8-pin), an ALC input jack, a send control jack (this goes to ground while transmitting to control external equipment, such as a linear amplifier), an AH-3 control socket (external antenna tuner), a DC power socket, and a CI-V remote control jack (use with a personal computer for remote operation of transceiver functions). Lots of support!

The Instruction Manual

And last, but certainly not least, the 60-page Instruction Manual. I must say that it is written very well, in a manner that makes each page worth reading to discover the many other capabilities of the IC-737 not mentioned in this review. Also included are two large separate folded sheets of schematic diagrams. It might still take a magnifying glass to check the components (at least with my eyes), but they are all there for those who want to know what makes it tick or just can't keep their fingers off the internal goodies.

Optional Features

Optional items available for the IC-737 include CW narrow filters, 500 and 250 Hz/-6 dB for both the 455 kHz (third IF) and the 9.0106 MHz (2nd IF); a UT-30 programmable tone encoder unit; a CR-282 high-stability crystal unit; and an MB-49 mobile mounting bracket; as well as all the rest of the optional items such as power supplies, microphones, etc.

The worst part of this review was knowing that David remembered who he gave the IC-737 to, and that I'd have to give it back to him. It's difficult to give up a quality well-built radio like this, but if I do, maybe he will let me do another radio review in the future.

I only have one more thing to say about the ICOM IC-737: "Try it—you'll like it!" I did!

IC-737 Specifications

Frequency Range		
	Receive	500 kHz-29.995 MHz
	Transmit	1.800-1.99900 MHz
		3.500-4.000 MHz
		7.000-7.300 MHz
		10.100-10.150 MHz
		14.000-14.350 MHz
		18.068-18.168 MHz
		21.000-21.450 MHz
		24.890-24.990 MHz
		28.000-29.700 MHz
Mode	SSB, CW, AM, FM	
Memory Channels	101	
Antenna Impedance	50 ohm nominal	
Usable Temperature Range	-10°C +60°C	
	+14°F +140°F	
Frequency Stability	Less than +/-200 Hz from 1 min. to 60 min. after power ON. After that, rate of stability change is less than +/-30 Hz/hr. at +25°C; +77°F. Temperature fluctuations (0°C to +50°C; +32°F to +122°F) less than +/- 350 Hz.	
Power Supply Requirement	13.8 V DC +/-15% (20A)	
Current drain	Transmit	20A
	Receive squelched	1.6A
Max audio output	2.1A	
Dimensions	330(W) x 111(H) x 285(D) mm	
	13.0(W) x 4.4(H) x 11.2(D) in	
Weight	8.05 kg; 17.7 lb.	
Transmitter		
Output power	SSB,CW,FM	10 to 100 watts
	AM	10 to 40 watts
Spurious emissions	Less than -50 dB	
Carrier suppression	More than 40 dB	
Unwanted sideband	More than 50 dB	
Microphone impedance	600 ohms	
Receiver		
Receive system	Triple-conversion superheterodyne	
Sensitivity (Preamp ON)	0.5-1.8 MHz	AM
Less than 13.0 μV for 10 dB S/N		
	1.8-29.995 MHz	SSB, CW
Less than 0.16 μV for 10 dB S/N		
		AM
Less than 2.0 μV for 10 dB S/N		
		FM (28-29.7 MHz)
Less than 0.5 μV for 12 dB S/N		
Squelch sensitivity	SSB	Less than 5.6 μV at threshold
	FM	Less than 0.3 μV at threshold
Sensitivity	SSB, CW	More than 2.1 kHz/-6 dB
		Less than 4.0 kHz/-60 dB
	AM	More than 6.0 kHz/-6 dB
		Less than 20.0 kHz/-40 dB
	FM	More than 12.0 kHz/-6 dB
		Less than 30.0 kHz/-50 dB
Spurious and image rejection ratio	More than 70 dB	
Audio output power load	More than 2.6W with a 10% distortion and an 8 ohm	
RIT/TX variable range	+/- 2.5 kHz max.	
Antenna Tuner		
Matching impedance range:	16.7-150 ohm unbalanced	
	(VSWR less than 3:1)	
Min. operating input power	8W	
Waiting time for band changing	Less than 3 seconds	
Tuning time	Less than 7 seconds	
Tuning accuracy	VSWR 1.5:1 or less	
Insertion loss (after tuning)	Less than 1.0 dB	

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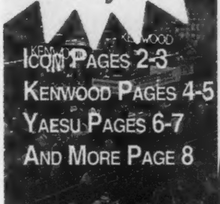
- ICOM PAGES 2-3
- KENWOOD PAGES 4-5
- YAESU PAGES 6-7
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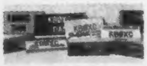

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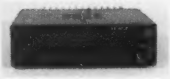

It's here! The 9600 baud data radio is committed to your digital success. True F.M., fast switching with a high duty cycle makes this ready for your packet station.
- DR1200T $269.95

$299⁹⁵

DR-430

Based on the proven design of the DR130, this 440 MHz mobile is just in time to show off at Dayton.

*FCC type acceptance may be pending at the time of this publication. The information as presented is preliminary.
- DR-130T $319.95

$369⁹⁵

-G1T

$329⁹⁵

-580T

A super-compact handheld, the tiny DJ-580T is a powerful, feature packed twin bander. This super-compact HT is the smallest you'll find, and literally fits in the palm of your hand. Ergonomic design combined with excellent sensitivity and unbelievable great sound, sets a new standard for miniature HT's.

$399⁹⁵

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IC-737A

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This advanced transceiver features DDS, dual antenna ports, dual VFO display, 101 memories, internal antenna tuner, built-in keyer and 105 dB dynamic receive range. Join the DX scene with the latest design.

$1489.95

IC-R1

In a world filled with signals and sounds you need a communication system you can rely on. Now you can hear communications around the globe with a tiny package that fits snugly in your pocket– Icom's IC-R1, one of the smallest communications receivers ever produced. Other features include 100 memories from 100 KHz through 1300 MHz, AM, FM and FM wide modes and clock function.

$489.95

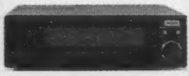
IC-728

SAVE $100 MORE

The IC-728 is a full featured transceiver providing pleasurable HF operation with features such as passband tuning and speech compression. Perfect for mobile operation too. **Supplies Limited.**

$899.95

IC-2330A



Get ahead with dual band superiority. Even though it is loaded with many attractive functions for complete dual band capability, it is compact. Like a mono-band transceiver, it fits anywhere, in any vehicle. 36 memories, DTMF microphone, and 3 power levels. Supplies Limited.

$499.95

IC-781

Seeing is believing, so enjoy the view. The built-in video display is your spectrum scope, frequency readout, terminal monitor and control screen. Dual receive, 150 watt output, 99 memories and wide dynamic range add up to a performance leader.

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IC-707

SAVE $50 MORE

Here's 9 pounds of fun with a display that's easy to see, a front panel that's easy to work with, and performance to spare. You get big rig specs in an HF transceiver designed for mobile and portable use. Features include a noise blanker, pre-amp, 100 watts out, 32 memories and great sensitivity.

$839.95

IC-R100

Bring the world to your car. Now you can enjoy a wider world of broadcasting- VHF air and marine bands, AM, FM, WFM modes, emergency services and many more- in your vehicle. Fully covers all the stations worth hearing in the 500 kHz-1.8 GHz range.

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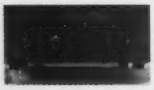
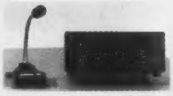
IC-729



The IC-729 includes the exciting 50 MHz band in an HF all-band/all-mode transceiver. Features include passband tuning, speech compressor, VOX and more to increase your DX communication.

$1239.95

IC-735



The classic HF all-band transceiver that you've been looking for...the most compact and advanced full-featured radio with general coverage on the market.

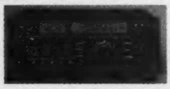
$1049.95

IC-765

Performance with easy-to-use features. With a full-featured front panel and a large fluorescent display, this radio was designed to be used! Wide dynamic range, full duty cycle heat sink, 99 memories, DDS and high speed antenna tuner will expand your fun.

$2595.95

IC-275H



The beauty of the all-mode IC-275H from Icom is that is gives you the best of both worlds- accessibility to he far-flung reaches of the earth combined with tremendous simplicity. At just the touch of a few switches you can contact places in the world you've always dreamed of visiting.

IC-475H–70cm all mode

IC-575H– 6m all mode

$1389.95

IC-R7100

Continuous frequency coverage from 25 MHz through 2000 MHZ with all mode capability (W.F.M.opt.). This unit offers a clock, timer, 900 memories, scanning and more than there's room to list.

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IC-281

NEW

This new IC-281 mobile radio packs a triple punch with its many features. It hosts bonus band 440 MHz receive and a 9600 baud data radio port all for a price that's hard to beat.

$379.95

IC-736

NEW

Here's the H.F. rig you've been holding out for! It features a full 100 watts output from 160 meters, 100 watt through 6 meters with a built in antenna tuner and power supply, VOX, PBT, RF Gain, 101 memories and more provides you with the latest features and fun.

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IC-W21AT

This new dual band offers innovative features amateurs have come to expect from Icom. Auto-output power selection, 70 memories, pager function, CTCSS, and more.

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IC-2GXAT

High power & compact design set a new performance pace. This new HT offers 40 memories, Die cast case, CTCSS. Its fresh and exciting from Icom.

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IC-T21A

Dual receivers with single band transmit makes this HT truly versatile. The 6 watt output, lit keypad, fast scan, DSQ, clock, 114 memories and a compact design add up to a great new product.

$325.95

IC-2700

See Me at Dayton

This new 2 meter/70cm dual band mobile will wow you with all its new features. It sports a removable front panel, separate controls for tuning-volume and squelch,Remote control mike. See it at Dayton along with the IC-3700H for your 70cm/ 1.2 GHZ needs.

$789.95

IC-Δ100H

NEW

Here's a triple band mobile ready to go out of the box. This rig is packed with features to please your operating needs. Experience the magic of Icom.

$1399.95

IC-Δ1A

SAVE $100 MORE

The IC-Δ1A and IC-Δ1E are the first VHF/UHF triband handhelds in the amateur world. 144 MHz, 430(440) MHz and 1200 MHz band units are included in one compact body. Triple band operation in the palm of your hand. **Limited Supplies.**

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IC-2iA

SAVE $50 MORE

This ultra-slim transceiver is designed for maximum portability and convenience. Even with its NiCd battery pack attached, this transceiver can fit in your shirt pocket or hand bag. CTCSS, clock and 100 memories are standard features.

FREE HM55 DTMF SPEAKER MIC

$319.95

IC-W2A

SAVE $30 MORE

A return to design fundamentals has produced something truly unique in dual-band FM transceivers. Even though it is the smallest in its class, it is packed to the limit with features to expand your fun out-of-doors, on the road, or at home.

Limited Supplies.

TPR
$479.95

IC-820H

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This new satellite Dual band all mode base. Its designed to provide critical performance with Icom technology competitively priced. Features include Data port, 50 memories, TXCO, Noise Blanker, DDS. Compact size and much much more. **$TBA.***

*TBA

IC-2340H

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This new 2 meter/ 440cm Dual band is another star in a new product line up for Icom. Features include separate tuning, volume and squelch controls for each band, 100 memories, high power out-put make this competitively priced unit a real winner.

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TH-22AT

SAVE $20 MORE

Small just got smaller. Kenwood's new TH-22AT is in a category all its own. This new FM transceiver features long battery life, DTMF keypad, user-friendly menu system, scan functions, 41 memories, CTCSS encode, DTSS, and much more.

*Supplies might be limited

$248.04

TS-790A

The TS-790A breaks new ground in terms of features and performance. With the optional 1200 MHz unit, it offers tri-band coverage for maximum versatility. Supporting its dual-frequency receive capability are separate readouts and controls for main and sub bands, even full-duplex cross-band operation is possible.

$1789.95

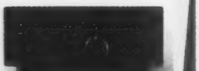
TH-78A

SAVE $30 MORE

Compact and confident, it sets exciting new standards for portable communications, combing simplicity of operation with a multiplicity of features. In addition to built-in DTSS and paging functions, it provides a dual-frequency transceive capability, wide band receive, a sliding keypad cover, and many other features. While supplies last.

$417.84

TS-850S/AT



Kenwood's technology endows the TS-850S/AT with specs that place it at the top of amateur radio equipment. Automatic antenna tuner, 100 memories, three scan modes, DDS, digital PLL system plus more.

$1695.95

TS-450S/AT

SAVE $50 MORE

A compact, lightweight radio with 100w transmission capabilities on all nine amateur bands. Rugged reliability is matched with leading-edge electronics, automatic antenna tuner, AIP system, and DDS for fine tuning.

$1279.95

TS-140S

The perfect entry-level HF transceiver. All-mode performance is enhanced by numerous by numerous user-oriented features such as 31 memories, a dual-mode noise blanker with level control, CW full & semi break-in, built-in speech processor and it's light enough for DX-peditions and mobile use.

$899.95

TS-950SDX

SAVE $100 MORE

Swift performance and surgical precision are second nature to the TS-950SDX. Quality engineering blends aesthetic simplicity of form with a wide range of advanced features- dual frequency receive, 100 memories, DSP, MOS FET final section (a first for amateur transceivers) and much much more.

$3917.95

TH-28A

This state of the art HT has numerous features- the ability to store both alphanumeric and frequency data in non-volatile memory, AM aircraft, alphanumeric message paging–in addition to DTSS and pager functions–plus switchable dual-band receive. As an added bonus the number of memory channels can be increased to 240 (option).

$309.95

TS-690

A radio that can star in virtually any role with it's 100w transmission capabilities on nine amateur bands plus 50 watts output on 6 meters. Compact, lightweight construction makes this HF transceiver particularly suited for DX-ing. Rugged reliability is matched with leading edge electronics, Kenwood's AIP system for improved dynamic range, DDS for fine tuning and the optional DSR-100 digital signal processor.

$1409.95

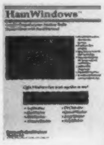
TL-922A

See Me at Dayton

The TL-922A is an HF Linear amplifier designed to provide maximum legal power. By utilizing two 3-500Z high performance transmitting tubes, you'll have plenty of reserve power for those DX and contest contacts. Features include 2kw PEP output, 2 meters, variable ALC, delay cooling, class AB, bias and a look to match those Kenwood products.

$1729.95

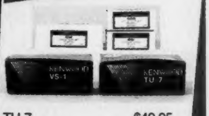
Ham Windows



Graphic control of your amateur radio station with Ham Windows. The LogWindow monitors the DX cluster, shows your current log and provides current DXCC and WAZ award status. The system also interfaces to HamBase. Spot, work and log new countries with the latest point-and-shoot technology. **HW-3P**

$149.95

Filters



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VS-1	$67.95
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YK-88C-1	$99.95
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YK-88S-1 (1 st F)	$94.95
YK-88SN-1	$94.95
YK-455C-1 (2 nd F)	$109.95
YG-455C-1 (2 nd IF)	$144.95
YG-455CN-1 (2 nd IF)	$159.95
YK-455C-1	$109.95
YK-88S-1	$99.95

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KENWOOD DAY MAY 7, 1994

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- ▼ TL-922A
- ▼ TH-22HT
- ▼ TS-790A

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TS-60

Here's the twin to the TS-50. Engineered for 90 watts of fun on 6 meters. Features include 100 memories, compact size, DDS, large L.C.D. panel and more.

$997⁹⁵

* This device has not been approved by the Federal Communications Commission. This device is not and may not be offered for sale or lease or sold or leased until the approval of the FCC is obtained.

TM-255A

NEW Sneak Preview

This new all mode mobile will provide new fun for Satellite, Packet and DXing. The list of new features include a 9600/1200 baud data terminal, increased output now at 40 watts, DDS circuity,CTCSS encode and much much more. **$TBA* FCC Approval Pending**

TBA

TS-50S

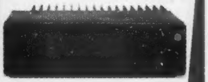
SAVE $50 MORE

Enjoy high performance communications plus go-anywhere convenience with the world's smallest 100w mobile HF transceiver. All modes and all bands complete this package. Limited supplies.

$969⁹⁵

TM-241A

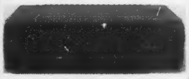
SAVE $30 MORE



This 2 meter FM mobile comes complete with extra-large display, DTMF microphone, wide band receive and illuminated switches.

$339⁹⁵

TM-732A



Attuned to the fast-moving world of mobile communications, this dual-band transceiver offers many features includung a detachable front panel in a compact design.

$569⁹⁵

TM-251A

NEW

This new 2 meter transceiver provides dual band receive and gives you a data port that's 9600 baud ready. CTCSS encode, 41 memories are expandable, cross band repeat, time out timer, DTSS and much more.

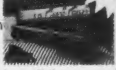
- TM-451A 70cm Tx,2m Rx *TBA
- TM-551A 1.2GHz Tx 70cm Rx *TBA

*FCC Approval pending

$439⁹⁵

TM-742A

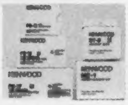
SAVE $40 MORE



New VHF/UHF tri-bander with third band optional. This new transceiver has all the features and advantages of the TM-741 plus these enhancements-direct frequency entry, the unit can separate into three pieces (requires remote cable kit), CTCSS encode is built in, and it can be controlled remotely with DTMF signals from any transceiver. Also available in a tri-band model (the TM-942A).

$695³⁶

Accessories



BC-15A	$109.95
BH-6	$39.95
BT-8	$26.95
HM-2	$16.95
HMC-2	$63.95
KLF-3	$23.50
ME-1	$34.95
PB-13	$63.95
PB-14	$89.95
PB-17	$99.95
PB-18	$86.95

Accessories

SP-31	$94.95
SP-23	$79.95
SP-950	$124.95
DTU-2	$29.95
UT-10	$539.95
UT-50S	$309.95
UT-28S	$309.95
UT-220S	$309.95
UT-440S	$309.95
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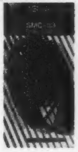
IF-232C

Kenwood provides a variety of devices to add computer control or allow some units to be worked remotely. **IF-232C** converts personal computer RS232 levels, to levels used with Transceivers such as; TS-950 series, TS-850 series, TS-690 series, TS-790A series, TS-450 series and the R-5000.

$109⁹⁵

Accessories



PG-2W	$14.95
KLF-3	$23.50
SC-33	$19.95
SC-34	$21.95
SC-35	$19.95
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SMC-32	$44.95
SMC-33	$57.95
SMC-34	$59.95

Event

See Kenwood on the main floor at Hara Arena at Dayton, Ohio April 29, 30, and May 1, 1994.

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FT-1000/D

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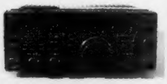
FT-990/AT



A blend of high performance features borrowed from the FT-1000 family are combined in this affordable transceiver. IF shift, variable notch filter, variable noise blanker, VOX and antenna tuner are included.

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FT-990

The new FT-990 combines the basic technical features of that top-of-the-line model with several new advances in both transmitter and receiver circuitry. Digital filter, 90 memories, wide dynamic range and much more!

FT-990/DC $1739.95

$1995.95

FL-7000

Solid state design with a built in antenna tuner makes for a no fuss QSO in tough conditions is a full 1200 watts input on all bands with automatic or manual tuning lets you decide the best way to drive this competitor.

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FT-290R/II

Portable or mobile, this 2 meter all-mode transceiver delivers fun and function. The 25 watt linear amplifier clips on in place of an optional battery case to extend your operating horizon.

FT-690R/II 6m transceiver	$669.95
FT-790R/II 70 cm transceiver	$649.95

$548.62

FT-747GX

Perfect portable proportions in a full-featured 100 W transceiver. This radio gives rugged lightweight performance in your car, boat or cabin. Just right for home, too!

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FT-840

This new transceiver delivers the fun and performance you're looking for while staying on a budget! It has 100 watt output, 100 memories, DDS, IF Shift FET front end and a general coverage receiver.

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FRG-100B

This new high performance table top receiver provides general coverage from 50 KHz - 30 MHz in all and FM at an affordable price. Features include 50 memories, noise blanker, 10 MHz, 100 and 1 KHz tuning steps, selectable attenuate, twin clocks and scan mode.

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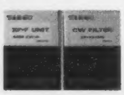
• MH-29A2B	$105.00
• MD-1C8	$129.95
• MW-1	$109.95

Accessories



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• XF-10.9M	$124.95
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• SP-3	$21.00
• SP-4	$30.00
• SP-7	$37.00

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- ▼ FT-736R
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NEW

This new HT packs the features you want in a small size. It features a new alphanumeric display, super small profile, new square "D" battery design, lit keypad, AM air craft receive, DSQ & CTCSS encode.

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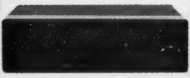
FT-5200



The removable front panel lets this dual bander fit any installation. It features 50w out on 2 meters, 35w out on 70 centimeters, 32 memories, CTCSS encode and PAGE mode.

$629.95

FT-5100

This dual band mobile features 100 memories, cross band repeat, lighted keypad, built-in duplexer and a small footprint. Dual watch capability rounds out this 50/35 watt VHF/UHF transceiver. Packet ready.

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FT-2200

This compact, full-featured mobile comes with 49 memories, 10 DTMF autodial memories, A.R.S., CTCSS encode, digital squelch and lighted keypad are standard features.

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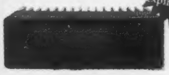
FT-2400H

SAVE $50 MORE expires 5/7/94



This rugged military-grade 2 meter mobile provides wide band receive, 3 power output levels, a lighted keypad and 26 memories. Join the fun!

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Has the same great features as the FT-2400 but is designed for the 440 band.
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The newest member of the dual band family. This handheld sports auto tone search, 82 memory channels, automatic power off, built-in VOX, dual in-band receive feature, built-in cross band repeat function and much more.

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This new VHF handheld transceiver provides the latest features-auto tone search, automatic battery saver, automatic power off, 41 memories, CTCSS encode/decode, DTMF paging, backlit keypad and display and a choice of two colors (black or gray). FT-816 UHF version available. **Supplies Limited on gray.**

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Gray only

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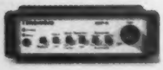

• DSP-9	$169.00
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This next generation of multi-mode controller is made in the USA with a front panel designed for you! Enjoy dual port action for packet, RTTY, PACTOR, CW, fax, and more!

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TELEX hy-gain

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DAIWA

NS-660A
Cross needle, 1.8-150 MHz SWR meter with remote capability. **$185.95**
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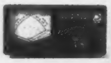

CN-101
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9096	RG8U, superflex	$ .62
6214	14 gauge Copperweld	$ .10
5450	450 ohm twinlead	$ .14
8612	18/6, 16/2 8 conductor wire	$ .48
3266	18 gauge/6c conductor rotor wire	$ .34

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Number 9 on your Feedback card

by Charles Warrington WA1RZW

The Ham Contact
P.O. Box 3624, Dept. 73
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The Power Station

A multi-function, portable, rechargeable power source.

Just think of all the devices you can run from your car's cigarette lighter outlet these days. There are HTs and HF rigs, CD players and spotlights, shavers and soldering irons, refrigerators and coffee pots—even power tools. Now, with cigarette smoking's fall from fashion, auto-makers will probably soon begin calling these "accessory power outlets," or possibly replace the lighter itself with a simple protective cover. Instead of a smoldering butt symbol you might instead see a symbol for a battery or the word "ACCESSORY." What started out as a way to light up your smokes has evolved into an all-purpose power source.

Too bad your car isn't all that handy at times. So, with a bevy of gadgets tethered to your dash, wouldn't it be nice if you could just yank that little outlet and *take it with you* when you need it? How about camping? Or fishing? Or just operating your HT at your home QTH at high power like a base station?

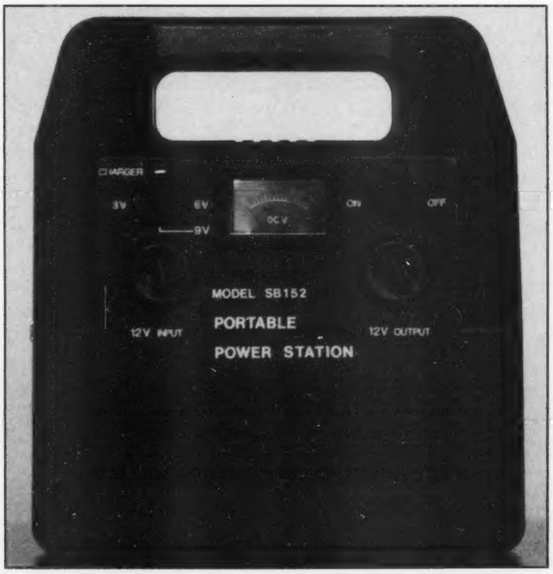
Well, wish no more, because the folks at The Ham Contact are now importing and distributing the Power Station—a slick little rechargeable gell cell battery source that you can take with you anywhere. Let's take a look at what the Power Station has to offer.

Features

The heart of the Power Station is a 7.0 amp-hour rechargeable gell cell battery. By means of comparison, the NiCd battery in your HT is probably rated at 400 or 600 mAh. Thus, you could multiply the life of your HT battery by about 14 times, just to give you an idea. And, while nickel cadmium batteries suffer the dreaded memory effect, these gell cells do not.

The unit is shipped complete with a wall charger, and the *CHARGE* light blinks when the unit is fully charged. Also included is an 8-foot double-ended cigarette lighter cord. This allows you to recharge the Power Station from your automobile battery when you are on the road.

The output is switchable from 12 volts to 9 volts to 6 volts to 3 volts—four output levels to accommodate a wide variety of devices. The 3, 6, and 9 volt output is at a 3.5 mm coaxial jack on the side of the unit; the 12 volt output is available at the female cigarette lighter socket and at the output studs under the back cover. You can draw current from any or all at the same time.



The voltmeter on the front of the Power Station normally reads output voltage, but it can also read the condition of a car battery when the lighter plug-to-lighter plug cord is used.

A Good Idea

I felt some sense of comfort during the horrendous ice and snowstorms we suffered recently here in New England knowing that I had some method of dependable back-up communications. The Power Station was also mighty nice to have when the lights went out, since I happen to own a 12 volt halogen spotlight and a 12 volt television set, and both are equipped with cigarette lighter plugs.

Another advantage to owning one of these units is realized when your car battery begins to give up. The Power Station can be helpful in two ways: as a charger and as a booster.

In very cold weather, you can run jumper cables from the Power Station to your car battery and give it a quick charge before starting. Or, you can pull up to 100 amps from the Power Station for just a matter of seconds—long enough to jump start the old jalopy. While the 12 volt output cigarette lighter socket is fused at 10 amps, the 12 volt output at the studs under the rear cover is not fused—permitting short bursts of high current.

Conclusions

The Power Station would be a welcome addition to any ham shack. It is a quality product constructed of heavy-duty ABS plastic and is UL approved. The unit can be recharged from a standard wall socket in about eight hours, or from your car's cigarette lighter socket in about three hours (with the engine running).

The Power Station is truly portable at about 7.5 pounds and measuring approximately 7.5" x 2.5" x 8". The charging circuit shuts off automatically to prevent overcharging. The voltage-sensing circuitry protects the unit and extends its life. You can run all three outputs at the same time, at two different voltages, making this a versatile unit.

You will also enjoy the instruction manual. The translation from Chinese is often humorous. Still, the information is easily understood. Add a multiple outlet adapter like Radio Shack's 270-1544 to the Power Station and go nuts! I wish they had these when we were kids. It sure would have livened up the old tree house.

Number 13 on your Feedback card

Improved QRP Keying Circuit

A slick fix for your little CW rig.

by Steven Weber KD1JV

If you've ever built a simple QRP transmitter, the keying circuit you used probably looks something like the one shown in Figure 1a. If you look at the wave shape of the RF output of your transmitter with a scope, you will see just slightly rounded edges on the signal as you key. Also, if you trigger your scope upon key closure, you will notice it takes a few milliseconds before you even get an output. Why does this happen?

Referring back to Figure 1a, when you close the key, capacitor C1 starts to discharge through resistor R1. At some point enough charge is taken from the capacitor and current starts to flow through the emitter of Q1, starting to turn it on and supplying power to your amplifiers. The amount of time it takes for Q1 to start to turn on after key closure is hard to say as the voltage across C1 does not follow the normal RC discharge curve. It only has to discharge enough to start to turn on the transistor and then the gain of the transistor modifies the curve. An additional delay is caused by the fact that the RF amplifiers don't start to turn on until there is 2 to 3 volts across them. By the time you start to get any signal out of your transmitter, a significant amount of time has gone by since key closure and Q1 is well on its way to being fully turned on.

When you release your key, C1 charges very quickly through the emitter-base diode junction of Q1. To slow down the turn off time a fairly large capacitor, C2, is added to the circuit. This gives the trailing edge of the keyed signal a shape closer to what you would expect to see. However, it takes a few milliseconds before C2 charges up enough to start to turn Q1 off, again creating a delay.

"So what?" you might ask. Well, it's not much of a problem with real low-power rigs, but when you get up to 5 or more watts of output power serious key clicks may be heard. If you try to round out the leading edge by increasing the value of C1 there will be even more of a delay between key down and signal output. This can make for clipped dots when sending at faster code speeds, making for very difficult copy on the other end of the QSO.

A Better Idea

I developed the circuit shown in Figure 1b to solve these problems for my 20 watt 40 meter transmitter.

Op amp U2b is a basic inverting amplifier with a gain of one. The capacitor C5 across the feedback resistor R11 makes it an integrator. The RC time constant of R11 and C5 determine the ramp time. The values shown will produce a 5 ms ramp. Use a good-quality capacitor for C5, such as a mylar or polypropylene type. A power transistor is placed inside the feedback loop so that the circuit can supply several hundred milliamperes of current. Control P2 sets the stand-by output voltage as seen at the emitter of Q2. U2a buffers the voltage from P2. This isolates the pot from the input of the integrator. With your key up, adjust the pot until you just start to see an output from your transmitter, then back off a little. Typically this will be between 2 and 4 volts. Your output signal will now have the proper 5 ms leading and falling edges and there will be no delay between key closure and the start of the output signal.

You must supply the op amp and collector of Q2 with at least 15 volts to produce a full 12 volts output on the emitter.

One-Chip CMOS Delayed T/R Control Circuit

In Figure 1b, when the code key is closed, the output of CMOS NAND gate A goes high, charging cap C3 through D1. The output of gate C then goes high, activating the T/R relay and the oscillator/mixer/or VFO offset. One input to gate D is slightly delayed to allow the relay and oscillator or VFO to settle before the initial keying of the amplifiers. When the key is released, the cap C3 starts to discharge through R2, P1. If the key is not closed again before C3 discharges to 1/2 of Vcc, the T/R relay will open and switch you back to receive. ■

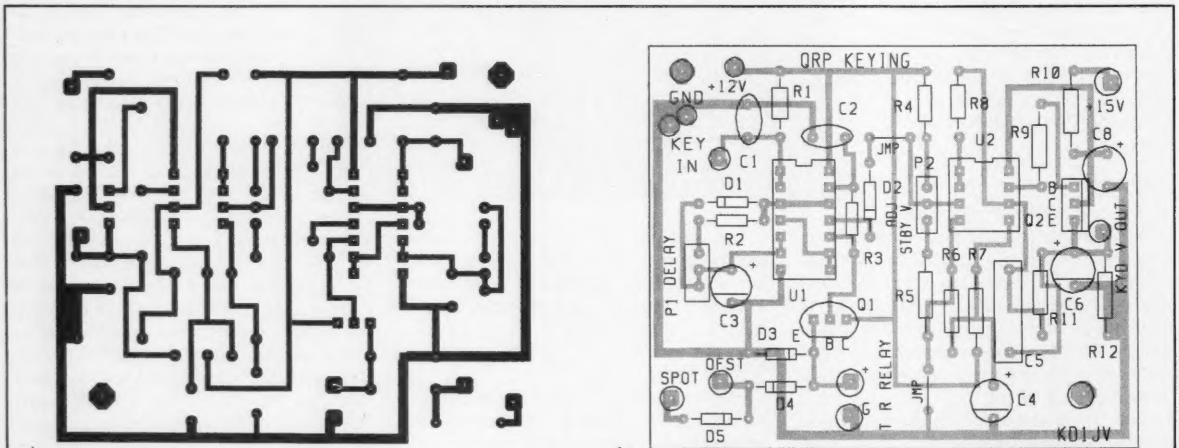


Figure 2. Improved QRP Keying Circuit PC board and parts placement diagram.

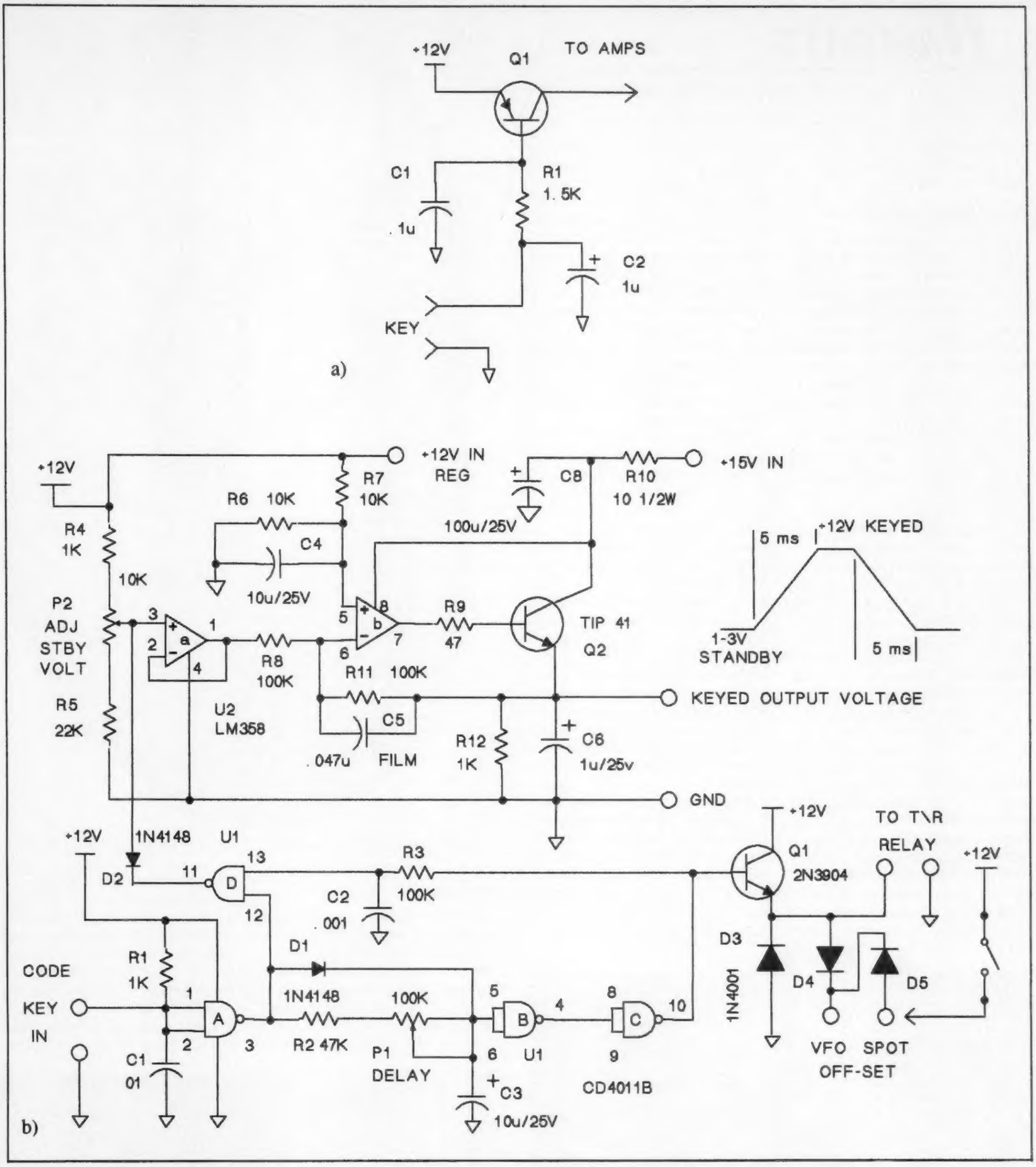

+12V
Q1
TO AMPS
C1
.1u
R1
1. 5K
C2
1u
KEY
a)
+12V
+12V IN
REG
R7
10K
R6 10K
C4
10u/25V
C8
100u/25V
R10
10 1/2W
+15V IN
R4
1K
10K
P2
ADJ
STBY
VOLT
R5
22K
a
U2
LM358
R8
100K
b
R9
47
TIP 41
Q2
R11 100K
C5
.047u FILM
R12
1K
C6
1u/25v
KEYED OUTPUT VOLTAGE
GND
5 ms
+12V KEYED
1-3V
STANDBY
5 ms
+12V
1N4148
U1
D2
D
R3
100K
C2
.001
+12V
Q1
2N3904
TO T\R
RELAY
+12V
D1
CODE
KEY
IN
R1
1K
A
C1
01
1N4148
R2 47K
100K
P1
DELAY
B
C
C3
10u/25V
U1
CD4011B
D3
1N4001
D4
D5
VFO SPOT
OFF-SET
b)

Figure 1.a) Typical QRP keying circuit; b) Improved QRP Keying Circuit with CMOS T/R keying control.

Parts List

R1,4,12	1k 1/4W	C1	0.01 µF disk cap	Q1	2N3904 NPN
R2	47k 1/4W	C2	0.001 µF disk	Q2	Tip 41-to-220 NPN
R3,8,11	100k	C3,4	10 µF/25V electro	U1	4011B CMOS NAND gates
R5	22k	C5	0.047 µF poly-film type	U2	LM358 dual op amp
R6,7	10k	C6	1 µF/25V electro		
R9	47 ohm	C7	Skipped		
R10	10 ohm	C8	100 µF/26V electro		
P1	100k or 500k trimpot	D1,2	1N4148 diode		
P2	10k trimpot	D3,4,5	1N4001 1A diode		

Drilled and etched PC boards are available for $4 plus $1.50 S & H per order from FAR Circuits, 18N649 Field Court, Dundee, IL 60118.

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The Return of DOVE

Just over four years ago, on January 21, 1990, four small cube-shaped satellites were launched from the Kourou, French Guyana, spaceport as secondary passengers on an Ariane rocket. They began a new era in amateur-radio satellite communications. Among them was DOVE, the Digital Orbiting Voice Encoder. It would soon become known as DOVE-OSCAR-17.

DOVE is small, measuring only 10 inches on each side, and weighing just over 20 pounds. The satellite is composed of aluminum trays formed into a stack tied together with stainless-steel bolts and covered with solar cells for power. The internal trays contain the command receiver, flight computer, power module with batteries, S-band (2401.220 MHz) transmitter, AX.25 packet TNC (terminal node controller), digital-to-analog converter system, voice synthesizer and the 2 meter FM transmitters.

A 25-conductor ribbon cable runs between the modules carrying power, digital data, control signals and analog voltages from the various telemetry sensors. Each module has its own AART (Addressable Asynchronous Receiver/Transmitter). The inter-module communication runs at 4800 bps (bits per second) and has been described as a six-inch-long LAN (Local Area Network).

DOVE's mission is to transmit voice messages for educational and scientific purposes. The project was first proposed by Junior Torres de Castro PY2BJO. Junior is President of BRAMSAT (Sociedade Brasileira de Satelite Amador), the Brazilian counterpart of AMSAT-NA (The Radio Amateur Satellite Corporation), and is also a member of the Board of Directors of AMSAT-NA. Junior and BRAMSAT sponsored the program and paid for the satellite which was built in Colorado during the late 1980s. Junior was knighted by the president of Brazil for his contribution to the welfare of Brazil through the DOVE project.

During early software development efforts after launch the 2 meter transmitter became stuck in the ON condition. Usually the transmitter cycles to allow time for uplink commands. With the transmitter on continuously, DOVE's 2 meter command receiver was severely desensitized. Thanks to the efforts of W5UN and his extremely high ERP (effective radiated power) moonbounce station, a reset signal was forced into the command receiver during a period when the satellite's transmitter power was low due to low battery voltage. DOVE had been saved from potential disaster. The heavy cycling of the batteries could have caused irreversible damage to the power system.

In 1991 and 1992 students at the Chaminade College Preparatory School used DOVE for classroom projects. DOVE was beginning to meet its potential through educational efforts. A number of curriculum packages were developed at the school to teach science principles.

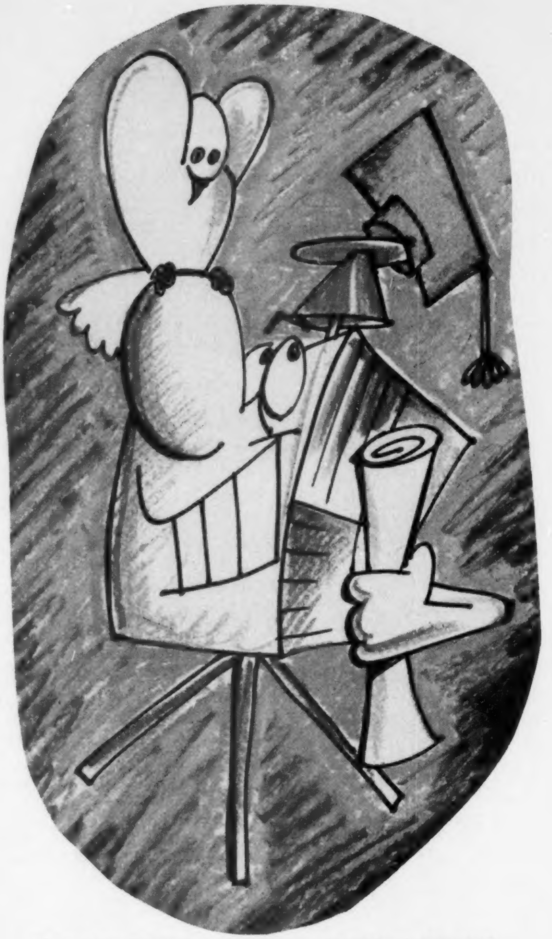

Photo A. The DOVE-Oscar-17 QSL from PY2BJO and BRAMSAT.

DOVE Talks

On May 24, 1992, strange voice signals could be heard on DOVE's 145.825 MHz FM downlink in between the bursts of packet telemetry. Sounding like the Colossus computer in the movie "The Forbin Project," the satellite was speaking a short sentence, "You are listening to Dove microsat." Command stations on the ground had sent code to the SC-02 voice synthesizer unit (now called the Arctic Technologies 263A) to activate the voice output. It worked, but after a few days the message became garbled. Since then the voice capability has been expanded, but the synthesizer does not represent the full voice capability of DOVE.

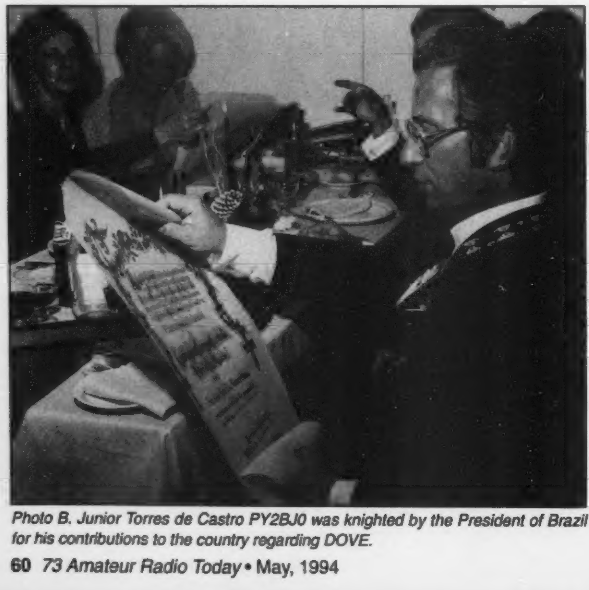

Photo B. Junior Torres de Castro PY2BJ0 was knighted by the President of Brazil for his contributions to the country regarding DOVE.

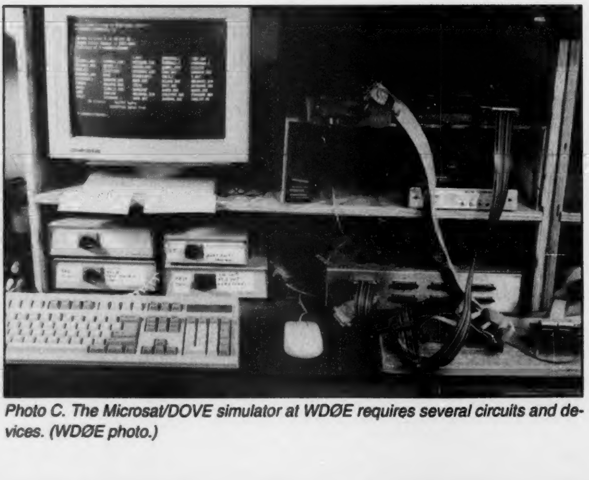

Photo C. The Microsat/DOVE simulator at WD0E requires several circuits and devices. (WD0E photo.)

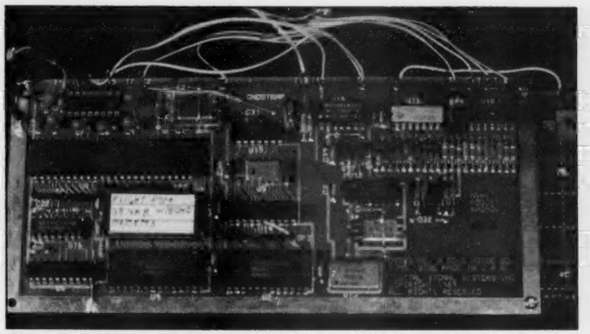

Photo D. Prototype DOVE voice and data module is used as part of the Microsat/DOVE simulator. (WDØE photo.)

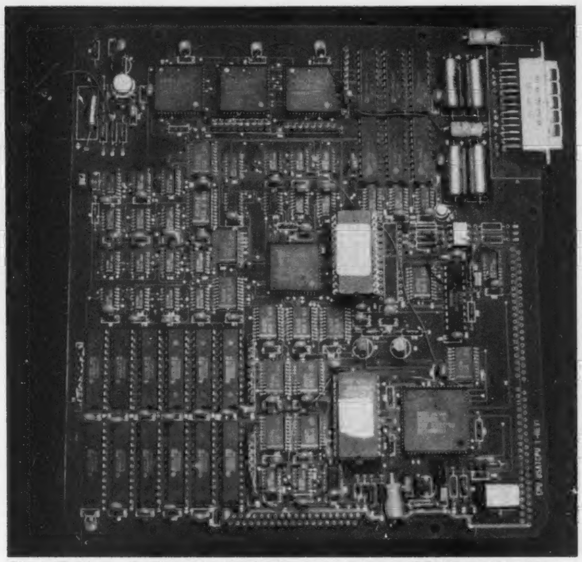

Photo E. Microsat software testing is done on a microsat CPU board like this one at WDØE. (WDØE photo.)

The unused digital-to-analog converter system was designed to allow uploaded digitized voice to be sent with fidelity close to the original recording. Work continues to bring this function online but no guarantees or estimates are possible since this is a volunteer effort.

The Failures

Since launch there have been some hardware problems that have made life difficult for the recovery team and ground controllers. The locked-on transmitter event earlier in DOVE's life could have destroyed the batteries. It is uncertain if the satellite could survive a repeat of that incident. Elaborate software watchdog timers have been implemented in the programming; with hope, this will help to avoid a future occurrence.

The AART communications chip on the module tray containing the voice system is not operating correctly. It can receive and act on instructions sent to it, but cannot respond back through the satellite LAN. This has required that programmers not demand any digital response from the voice unit to acknowledge commands.

Carrier suppression of the S-band 2.4 GHz transmitter failed completely. This means that the transmitter's signal can be easily detected, but the data carried by the modulation is

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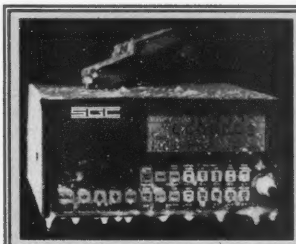

The SG2000 HF transceiver is type accepted for commercial and marine service made with traditional U.S. commercial radio quality (and of course it can be used on the ham bands also). While the Japanese radios have 2 final transistors that strain to put out 100 watts on the low bands and only 75-85 watts on ten meters, the SG2000 has 4 large transistors that loaf along at 150 watts on ALL THE BANDS INCLUDING 10 METERS! Some of the SG2000 features are: 1) A control head remotable (no special kit necessary) up to 150' away from the rig, perfect for automobiles and boats. Up to 8 heads can be utilized and used as intercoms also. 2) The largest display of any HF transceiver. 3) 644 pre-programmed memories and 100 user programmable memories. 4) operable from -50F (-45C) to 185F (+85C). You want quality right? Here is what EVERY SG2000 must endure before they're shipped from the factory: 1) They're factory aligned, 2) EVERY SG2000 is keyed down at full power (CW 150 Watts) into an open antenna for about 10 seconds, then connected to a shorted antenna and keyed down for an additional 10 seconds. 3) EVERY SG2000 is put in the "BURN-IN" rack and keyed down for 24 hours non-stop at full power CW. Don't try that with the foreign radios. 4) EVERY SG2000 is then re-checked for alignment and put in the "TORTURE RACK" where they are keyed on and off every 10 seconds for 24 hours. 5) The SG2000 is then re-evaluated and all control functions are verified to ensure that the microprocessor is up to spec. THEN AND ONLY THEN IS THE SG2000 ALLOWED TO LEAVE THE FACTORY.

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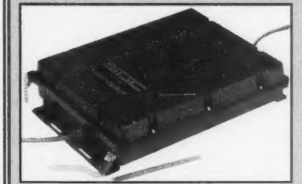

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difficult to detect. It is 20 dB below the carrier. An open capacitor may be the culprit, but there is no way to fix it. Using the S-band receive system of Bill McCaa KØRZ, in conjunction with DSP (digital signal processing) techniques, the low modulation levels have been received well enough to decode some of the S-band packets.

The temperature sensor on battery two is bad. This is more of an annoyance than a problem. It is only mentioned since someone monitoring the telemetry might get worried by the high values associated with this parameter.

DOVE Today

Extensive effort by the satellite's designers, builders and the current team of ground controllers has been needed to circumvent DOVE's problems. The result, four years after launch, is a functional satellite with a lot of potential. Key volunteers in the recovery team include Harold Price NK6K, Jim White WDØE, Bob Diersing N5AHD and Bill McCaa KØRZ. For day-to-day operation the lead command station is Richard Howlett VK7ZBX, with help from Russ Platt WJ9F. DOVE can be heard on 145.825 MHz FM sending standard AX.25 packet at 1200 bps. The signals are strong and can be heard on a handie-talkie. A typical home station set up for packet operation can easily detect and copy the messages and telemetry sent by DOVE.

The simplest approach to DOVE monitoring is to leave your packet station on 145.825 MHz and set your computer's communications program to a capture mode. Depending on your location there will be four to six passes above your horizon in a 24-hour period. After a day of monitoring, check the capture file for data. It may look something like that shown in Figure 1. Using information from Figures 2, 3, 4 and 5, this data can be deciphered.

A more sophisticated approach to telemetry capture is to use a computer with a satellite-tracking program to determine when the satellite is above the horizon, then tune for Doppler shift, use a beam antenna and collect the data on a PC with TLMDC-II, Whats- Up by G3ZCZ, or another microsat telemetry program.

Several satellite-tracking programs have been available as shareware and there are other good ones for sale. A source of commercial software is AMSAT at (301) 589-6062. One of their simpler PC track-

```
DOVE-1>BCRXMT-0 Sun Mar 06 05:51:38 1994
vmax=759160 battop=766771 temp=357713
DOVE-1>LSTAT-0 Sun Mar 06 05:51:39 1994
I P:0x3000 o:0 1:13884 f:13884, d:0 st:0
SWITCH-0>SWITCH-0  DM
DOVE-1>TIME-1 Sun Mar 06 05:52:01 1994
PHT: uptime is 119/11:39:04. Time is Sun Mar 06 05:52:20 1994
SWITCH-0>SWITCH-0  DM
DOVE-1>TLM-0 Sun Mar 06 05:52:05 1994
00:58 01:58 02:85 03:30 04:57 05:58 06:6C 07:54 08:6B 09:74 0A:A0
0B:E2 0C:E8 0D:D6 0E:00 0F:24 10:CD 11:A4 12:00 13:02 14:A8 15:95
16:96 17:92 18:94 19:94 1A:91 1B:8C 1C:98 1D:91 1E:25 1F:5C 20:B2
DOVE-1>TLM-0 Sun Mar 06 05:52:06 1994
21:9C 22:19 23:18 24:15 25:34 26:00 27:00 28:00 29:00 2A:00 2B:00
2C:00 2D:28 2E:00 2F:9F 30:CC 31:9E 32:00 33:00 34:C0 35:A4 36:AA
37:A8 38:B2
DOVE-1>STATUS-0 Sun Mar 06 05:52:06 1994
80 00 00 1E 41 18 CC 02 00 50 00 00 0A 0F 3C 05 17 00 0F 04 01
DOVE-1>_STAT-0 Sun Mar 06 05:52:06 1994
I P:0x3000 o:0 1:13884 f:13884, d:0 st:0
SWITCH-0>SWITCH-0  DM
DOVE-1>TIME-1 Sun Mar 06 05:52:31 1994
  PHT: uptime is 119/11:39:34. Time is Sun Mar 06 05:52:50 1994
  SWITCH-0>SWITCH-0  DM
  DOVE-1>TLM-0 Sun Mar 06 05:52:35 1994
  00:58 01:58 02:85 03:30 04:58 05:58 06:6C 07:54 08:6C 09:72 0A:9F
  0B:E0 0C:E8 0D:D6 0E:00 0F:24 10:CC 11:A4 12:00 13:01 14:A8 15:96
  16:8F 17:94 18:92 19:94 1A:92 1B:8C 1C:98 1D:92 1E:24 1F:5C 20:B0
  DOVE-1>TLM-0 Sun Mar 06 05:52:36 1994
  21:9D 22:19 23:18 24:14 25:34 26:00 27:00 28:01 29:00 2A:00 2B:00
  2C:00 2D:28 2E:00 2F:9E 30:CC 31:9E 32:01 33:00 34:C0 35:A4 36:AA
  37:A9 38:B2
  DOVE-1>STATUS-0 Sun Mar 06 05:52:36 1994
  80 00 00 1E 41 18 CC 02 00 50 00 00 0A 0F 3C 05 17 00 0F 04 01
  DOVE-1>BRAMST-0 Sun Mar 06 05:52:38 1994
  3rd March 1994
  DOVE reports have been received from:
Will Marchant        Richard Emerson
Steven Bible         Dave Reeves
Gilbert Mackall      Jim Lyons
Dorothy Baker        Paul Wiliamson
  These will change in 3 Days.
  [vk7zbx]
```

Figure 1. Sample of recent DOVE packet telemetry.

Equations are in the form: Y = A*Nr + B*N + C where:
N = Telemetry Count (00 - FF)
A, B, C = Equation Coefficients
Y = Result (In Specified Units)

HEX	Description	C	B	A	Units
0	Rx E/F Audio(W)	+0.000	+0.0246	0.000	V(p-p)
1	Rx E/F Audio(N)	+0.000	+0.0246	0.000	V(p-p)
2	Mixer Bias V:	+0.000	+0.0102	0.000	Volts
3	Osc. Bisd V:	+0.000	+0.0102	0.000	Volts
4	Rx A Audio (W):	+0.000	+0.0246	0.000	V(p-p)
5	Rx A Audio (N):	+0.000	+0.0246	0.000	V(p-p)
6	Rx A DISC:	+10.427	-0.09274	0.000	kHz
7	Rx A S meter:	+0.000	+1.000	0.000	Counts
8	Rx E/F DISC:	+9.6234	-0.09911	0.000	kHz
9	Rx E/F S meter:	+0.000	+1.000	0.000	Counts
A	+5 Volt Bus:	+0.000	+0.0305	0.000	Volts
B	+5V Rx Current:	+0.000	+0.00010100	0.000	Amps
C	+2.5V VREF:	+0.000	+0.0108	0.000	Volts
D	8.5V BUS:	+0.000	+0.0391	0.000	Volts
E	IR Detector:	+0.000	+1.000	0.000	Counts
F	LO Monitor I:	+0.000	+0.000037	0.000	Amps
10	+10V Bus:	+0.000	+0.05075	0.000	Volts
11	GASFET Bias I:	+0.000	+0.000026	0.000	Amps
12	Ground REF:	+0.000	+0.0100	0.000	Volts
13	+Z Array V:	+0.000	+0.1023	0.000	Volts
14	Rx Temp:	+101.05	-0.6051	0.000	Deg. C
15	+X (RX) temp:	+101.05	-0.6051	0.000	Deg. C
16	Bat 1 V:	+1.7932	-0.0034084	0.000	Volts
17	Bat 2 V:	+1.7978	-0.0035316	0.000	Volts
18	Bat 3 V:	+1.8046	-0.0035723	0.000	Volts
19	Bat 4 V:	+1.7782	-0.0034590	0.000	Volts
1A	Bat 5 V:	+1.8410	-0.0038355	0.000	Volts
1B	Bat 6 V:	+1.8381	-0.0038450	0.000	Volts
1C	Bat 7 V:	+1.8568	-0.0037757	0.000	Volts
1D	Bat 8 V:	+1.7868	-0.0034068	0.000	Volts
1E	Array V:	+7.205	+0.07200	0.000	Volts
1F	+5V Bus:	+1.932	+0.0312	0.000	Volts
20	+8.5V Bus:	+5.265	+0.0173	0.000	Volts
21	+10V Bus:	+7.469	+0.021765	0.000	Volts
22	BCR Set Point:	-8.762	+1.1590	0.000	Counts
23	BCR Load Cur:	-0.0871	+0.00698	0.000	Amps
24	+8.5V Bus Cur:	-0.0092	+0.001899	0.000	Amps
25	+5V Bus Cur:	+0.00502	+0.00431	0.000	Amps
26	-X Array Cur:	-0.01075	+0.00215	0.000	Amps
27	+X Array Cur:	-0.01349	+0.00270	0.000	Amps
28	-Y Array Cur:	-0.01196	+0.00239	0.000	Amps
29	+Y Array Cur:	-0.01141	+0.00228	0.000	Amps
2A	-Z Array Cur:	-0.01653	+0.00245	0.000	Amps
2B	+Z Array Cur:	-0.01137	+0.00228	0.000	Amps
2C	Ext Power Cur:	-0.02000	+0.00250	0.000	Amps
2D	BCR Input Cur:	+0.06122	+0.00317	0.000	Amps
2E	BCR Output Cur:	-0.01724	+0.00345	0.000	Amps
2F	Bat 1 Temp:	+101.05	-0.6051	0.000	Deg. C
30	Bat 2 Temp:	+101.05	-0.6051	0.000	Deg. C
31	Baseplt Temp:	+101.05	-0.6051	0.000	Deg. C
32	FM TX#1 RF OUT:	+0.0256	-0.000884	+0.0000836	Watts
33	FM TX#2 RF OUT:	-0.0027	+0.001257	+0.0000730	Watts
34	PSK TX HPA Temp	+101.05	-0.6051	0.000	Deg. C
35	+Y Array Temp	+101.05	-0.6051	0.000	Deg. C
36	RC PSK HPA Temp	+101.05	-0.6051	0.000	Deg. C
37	RC PSK BP Temp:	+101.05	-0.6051	0.000	Deg. C
38	+Z Array Temp:	+101.05	-0.6051	0.000	Deg. C
39	S band TX Out:	-0.0451	+0.00403	0.000	Watts
3A	s band HPA Temp	+101.05	-0.6051	0.000	Deg. C

Figure 2. Original DOVE telemetry decoding parameters. (N4HY)

The LSTAT line is sent by the loader portion of PHT (the loader/command/telemetry task). Its purpose is to show the state of the loader process so that if something goes wrong during upload, we can tell what needs to be done to continue the process.

The LSTAT line comes in two types, as shown below.

I P:0xhhhh o:n l:nnnn f:nnnn, d:n st:n\

A: 0xhhhh, P:0xhhhh, o:n l:nnnn f:nnnn, d:n st:n "I" Means there is no software load in progress (inactive)

A: Means a software load is in progress (active). hhhh is the segment address of the program being loaded.

P: The segment of the running program (PHT). the initial load of PHT is always at 0x3000. any other address here means PHT has been reloaded.

o: the number of times the HDLC output queue was full when PHT tried to send a frame. this is left over from debugging the only major bug found in the I/O drivers since launch. A bug occasionally caused a 65535 byte frame to be sent, filling the output queue for nine minutes. This should always be zero.

l: the largest free memory block, in decimal paragraphs. To find the number of free bytes in the largest block, multiply this number by 16. This number shows the largest program that can be loaded at that time.

f: The total amount of free memory, in decimal paragraphs.

d: The digipeat flag, 1 is digipeat on, 0 is digipeat off.

st: The task number of the last task loaded.

Figure 3. LSTAT line decoding for DOVE. (NK6K)

Following is a breakdown of information in the STATUS line presently transmitted by DOVE. This only applies to DOVE and the current on-board software.

Counting from the left, the first pair of numbers being 0. All data is in hex.

0 - Receiver status. Bits 0 - 3 = Filter status of RX A-D: 0 = 1200, 1 = 4800. Bits 4 - 7 = gain settings of IR sensor. Normal = 8 = log mode. Normal for whole position is 80 = IR in log, filters in 1200.

NOTE: receivers in DOVE are for commanding only.

1 - Unused

2 - Unused

3 - BCR Set point. Is adjusted by housekeeping task software to provide best power transfer from panels to regulators. Normally 1E during eclipse and in the 80s in the sun. Roughly corresponds to telemetry channel 22h.

4 - Number of hours since last command. See 18.

5 - BCR status bits. Indicates status of various latches in the BCR used to gather telemetry.

6 - Transmitter power level, 0 to F. First number is TX1, second is TX2, although they will normally be the same.

7 - Which transmitter is in use. Bit 0 (LSB) is TX1, bit 1 is TX2. A hex 02 indicates TX2 is in use, 01 would be TX1.

8 - Unused

9 - Status of switches in the voice/packet/s-band module (4). Will always be D0 in this version.

10 - Unused

11 - When WOD is in use, shows the number of samples taken/16. This provides a positive indication a collection has started, how far it has proceeded and when the sample bucket is full.

12 - Low end of nominal transmitter power range. See 13.

13 - High end of nominal transmitter power range. The housekeeping software moves the transmitter power between these two numbers to control the charge/discharge of the batteries, and keep the transmitter power as high as possible.

14 - Time between executions of the power control software in seconds.

15 - The transmitter power level that is set if the batteries get abnormally discharged. Normally 5.

16 - Count of errors on the s/c internal bus. This will increment on DOVE because module 4 no longer consistently responds.

17 - Overflow from 16.

18 - Days till the command timer will expire. Defaults to 2 on software start. Normally kept at F. This is another of the software "watchdogs" that attempt to assure the 2m transmitter doesn't get stuck on forever. If the s/c does not hear a command in this number of days, it jumps to the ROM boot loader firmware which turns all transmitters off.

19 - The module number the errors in 16 came from.

20 - Internal state related to transmitter lock-on avoidance. Normally 1.

Figure 4. STATUS line decoding for DOVE. (WD0E)

ing programs is currently being offered as a "perk" for new members who join at the $30 yearly rate. They have other more sophisticated programs with many different features. Any of them, including the "perk," are good for finding DOVE.

Tuning for Doppler shift is easy. Since the DOVE output is FM on 2 meters, tuning is not always necessary. The maximum Doppler shift on an overhead pass is no more than +/- 3 kHz. At the beginning of a pass the signal will appear a few kHz high. At closest approach the signal will be on 145.825 MHz, and as the satellite heads away it will appear a few kHz low.

DOVE has two 2 meter transmitters. Transmitter two is more efficient and is usually on. It runs RHCP (right-hand circular polarization) with the satellite's antenna array while transmitter one creates an LHCP signal. A typical vertically-polarized home-station antenna does well with either transmitter. A small beam that can be rotated in both azimuth and elevation planes is desirable but not required.

For data capture and automatic decoding, AMSAT offers TLMDC-II at $20 for members and $30 for nonmembers at the number above or via mail at: AMSAT-NA, 850 Sligo Ave. #600, Silver Spring, MD 20910. Reception reports can be sent to: Dr. Junior Torres de Castro (PY2BJO), 119 Macaubal, Sao Paulo, BRAZIL 01254, South America. Special DOVE QSL cards will be sent to those submitting reception reports. Junior and BRAMSAT are particularly interested in hearing about equipment used and signal quality. While actual telemetry listings are not currently needed, they would also like to hear of any educationally-oriented activities using signals from DOVE.

DOVE's Future

Even if the voice system is never fully exercised, many educational activities using DOVE are possible. Just a few of the studies conceivable include orbital mechanics, the speed of light and Doppler shift, thermal characteristics of the satellite, solar panel operation, satellite alignment with the earth's magnetic field, gravity and other general topics related to satellites and communications. If full voice operations become possible, many of the common telemetry outputs could be spoken rather than sent in hex code.

To amateur-radio operators, DOVE represents a very easy way to get started with hamsats. Most amateurs have some form of 2 meter equipment and can easily monitor DOVE's signal. The packet signals are easily captured by any packet system currently set up for terrestrial use. The 59 telemetry channels of data from this small cube in space offer information of interest to those engaged in satellite studies or just considering repeater telemetry systems or other remote-sensing experiments using ham radio.

When DOVE was brought back to 2 meter operation in November of last year, Junior PY2BJO offered his thanks to those involved in the satellite's recovery, "After a long time, DOVE is back again on 2m at 145.825 MHz. This project was created to provide an extremely simple way for those not familiar with satellite communications, especially those new to amateur radio, to take part in this exciting phase of our hobby. DOVE is finally beginning to live up to its original promise. After its rebirth, we at BRAMSAT are receiving many E-mail messages (PY2BJO@amsat.org) and letters. We are happy with this response, but we will be even happier when DOVE again becomes the popular satellite that we always knew it could be."

For further information on DOVE there are several publications covering the topic and other related satellites. All the books are available from AMSAT and include *Decoding Telemetry from the Amateur Satellites*, *The PACSAT Beginner's Guide*, *Proceedings of the AMSAT-NA Eleventh Space Symposium 1993* and *The Satellite Experimenter's Handbook*.

Following are the formulas for calculating the output power of the DOVE transmitters from the value in STATUS line. It's necessary to calculate the power because the transmitter is off when the telemetry is gathered.

Transmitter number 1 (not in use at present)
Output power = s^2 X .020460 + s X -.027435

Transmitter number 2 (presently in use)
Output power = s^2 X .022176 + s X -.051588

Where "s" is one of the digits in STATUS line position 6 (counting from zero on the left). These will get you within a tenth of a watt or so at the high end.

Figure 5. Output power calculations for DOVE.

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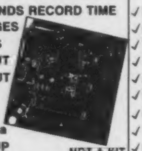

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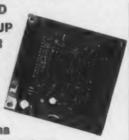

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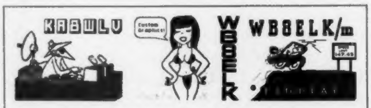

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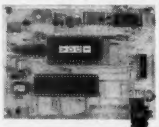

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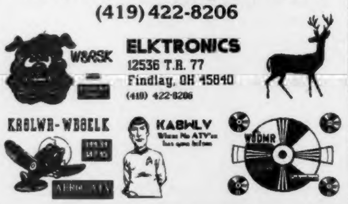

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RTTY LOOP

Amateur Radio Teletype

Marc I. Leavey, M.D., WA3AJR
6 Jenny Lane
Baltimore MD 21208

Last month I printed a few schemes used to mate the popular CP-1 interface, by AEA, with various computers. This month, with the help of F. A. Bartlett W6OWP of Paradise, California, let me share some more interfacing data.

Bart relates familiarity with AEA, Kantronics, and Microlog programs from the CP-1 era. While all three use the 5-conductor CP-1 cable and connect to the C-64 user port, each connects to different pins on that port. He is not aware of any programs for the C-64 that access the game port. CP-1 cables that terminate with a 9-pin joystick plug were normally intended to run with the C-64's baby brother computer, the VIC-20. While the CP-1 is the same for either computer, the cable used for the C-64 is the one that plugs into the user port. The pinout data for the CP-1 is as follows:

Pin 1—RTTY send/receive line from computer
Pin 2—RTTY input from computer
Pin 3—CW input from computer
Pin 4—Ground
Pin 5—CP-1 demodulator out to computer

Pin 5 is the left-hand pin, looking at the unit from the rear.

Referring to last month's diagrams, these would appear to be correct for AEA software, such as AEA MBATOR. Other software schemes hook up to different user port pins. See Table 1 for a comparison of several software connections.

As you can see, the software determines the use of each pin of the user port, so the connection to the CP-1 must be modified accordingly. If you are using some other form of software, with the data in the pinout chart you should be able to formulate a correct hookup if the software documentation does not give you the information.

My thanks to Bart for supplying much of this information. I am sure that many others will find it of use.

More Mail

Rick Newton KA3AUX of Pittsburgh, Pennsylvania, tells us that when he finds commercial RTTY stations on the air he is unable to copy them, even though he can tune in the signal. He wonders if they are using a speed that his C-64 cannot copy, or a code other than Baudot.

Well, Rick, as mentioned several times here in "RTTY Loop," commercial stations often run at speeds and with codes that "standard" RTTY programs cannot handle. Several of the newer programs around are able to digest these codes, though; and certainly multimode controllers, like those from AEA and Kantronics, handle them with ease.

To understand just what these stations are sending, there may be no better source than the Klingenfuss books mentioned a few months back. Just in case a new subscriber doesn't have the information, write to Jorge Klingenfuss at Klingenfuss Publications, Hagenloher Str. 14, D-72070 Tuebingen, Germany, for information on his extensive line of RTTY literature. And if you mention that you saw it in *73* magazine's "RTTY Loop," well, I have no idea what that will do for you, but it will make me happy!

While we're abroad, I'd like to acknowledge a note received from Jirka Hold OK1DR of the Czech Republic. He wrote that back when Czechoslovakia was still under Communist control, *73* magazine was illegally smuggled into the country for the benefit of that country's amateur radio operators. He was one of the first OKs to work with a Creed teleprinter, and eventually built a home-brew video terminal. His TU was also built from diagrams published in "RTTY Loop," many years ago. While the government interfered with operations during the 1980s, he is back on the air, and looks forward to giving an OK contact to his friends on RTTY in the States. George, I wish you all the best for success and continued solid operations!

"RTTY Loop" Software

Many of you have sent in requests for the "RTTY Loop" Software collection. Therefore, it gives me great pleasure to announce the fifth disk in the series. See Table 2 for programs contained on this disk, and brief descriptions.

As with the other collections, Disk #5 just about fills a 3.5", 1.44 Mb disk. So, for any or all of the "RTTY Loop" Software Collection, just send a blank disk (each collection fits on a 1.44 Mb disk), $2 in US funds per disk, and a self-addressed STAMPED mailer to return the package to you. Be sure to specify which disks you want, I am not clairvoyant! If you would like just a listing of what's available, send me a self-addressed, stamped envelope and I'll send you a printed list. That list is available on Email, as well. Now that America Online has an Internet gateway, you may reach me via Internet at MarcWA3AJR@aol.com, or on CompuServe at 75036,2501; or America Online at MarcWA3AJR; or Delphi at MarcWA3AJR.

I have some reviews in the works, and even a new online service, of interest to hams. Don't miss out, the next few months should be doozies! 73

CP-1 Pin	Kantronics HAMTEXT	AEA MBA-TOR	Microlog Airdisk
1	H	E	L
2	J	F	J
3	K	H	K
4	1 (one)	1 (one)	1 (one)
5	L	J	C

Table 1.

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JVFAX601.ZIP	JVFAX 6.0 is a multi-purpose program for the reception of both weather chart and photo style fax. For radio amateurs, there is an additional transmit option for fax and an SSTV transmit/receive facility.
JV_XMIT.GIF	GIF graphic of transmit adapter for sending SSTV with your computer and JVFAX program.
PACKPET.ZIP	PacketPeT Lite for Windows. Shareware version of commercial package, PacketPet for Windows, this is a Windows-based controller program for most hardware TNCs.
PACKY1.ZIP	Packy is a Windows program, designed for packet radio operation on ham radio frequencies using the AEA PK-232 or PK-88 controllers.
TOR32C.LZH	Run AMTOR on a PC with only a simple hardware interface.

Table 2.

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A "Universal" VFO Project

Variable frequency oscillators (VFOs) can be used to control the operating frequency of receivers or transmitters, or as a signal generator for testing radio and electronic circuits, or for a large number of other applications. This month's column is dedicated to a small VFO project, built on a printed circuit board, that can be incorporated into any of several different projects that you might design.

The Circuit

Figure 1 shows the basic circuit for the VFO, except for the tuning circuits (which are shown in Figure 2). Transistor Q1 is a junction field-effect transistor (JFET) oscillator stage. The device to use at Q1 includes MPF-102, 2N4416 and the replacement devices from the popular lines of "service" parts (e.g. ECG and NTE). The NTE-452 and ECG-452 can replace the 2N4416, while the NTE-312 or ECG-312 can replace MPF-102 devices. The ECG and NTE devices can usually be bought through local electronic parts distributors who cater to the service and repair industry. Alternatively, NTE replacement semiconductors can be ordered from Ocean State Electronics [POB 1458, 6 Industrial Drive, Westerly RI 02891; 1-800-866-6626 (orders); 1-401-596-3080 (voice); 1-401-596-3590 (fax)].

The oscillator is followed by a two-stage buffer amplifier consisting of Q2 and Q3. The selections for Q2 are the same as for the oscillator. For Q3, use a 2N2222 or some similar NPN silicon device.

Two different oscillator configurations can be accommodated by this design (i.e. both Clapp and Colpitts oscillators can be built). Both oscillators are the same from point "A" in Figure 1 forward, and both depend on a capacitor voltage divider feedback network. The Clapp oscillator (Figure 2a) is series-tuned, while the Colpitts oscillator is parallel-tuned (Figure 2b).

The tuning circuits shown in Figure 2 consist of an inductor (L1) and several capacitors. One of the capacitors is the main tuning capacitor (Ctun), and another is a trimmer capacitor (Ct). Several fixed capacitors (Ca1-Ca3) can be used (optional) in order to craft an L-C tuned circuit with exactly the right capacitance and tuning range. It is not necessary to use any of these capacitors. You may also lump all of the fixed capacitance into a single capacitor, if desired.

The DC voltage supplied to the oscillator transistor (Q1) is voltage-regulated. The voltage regulator can be any 78Lxx series from 78L05 to 78L09. If the 78L05 is used, there may be some problems getting it to oscillate. I didn't experience any such problems in this particular case, but in other cases the lower voltages produced some problems. However, drift is typically lower when the lower voltages are used.

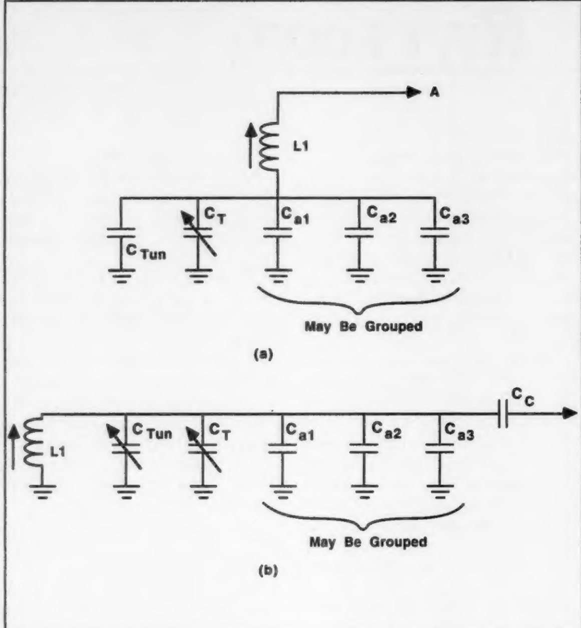

Figure 2. Tuning section of the VFO circuit: a) series-tuned Clapp; b) parallel-tuned Colpitts.

The values for the components can be developed from guidelines given by Doug DeMaw in *Solid-State Design for the Radio Amateur* (ARRL publication), p.34. As starting points (some experimentation may be needed) he recommends that L1 have a reactance of 140 ohms in the Colpitts case, and 260 ohms in the Clapp

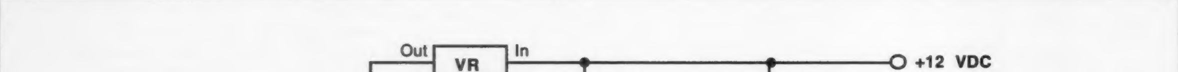

Figure 1. VFO circuit less the tuned circuits.

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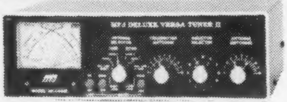

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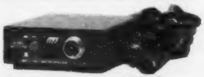

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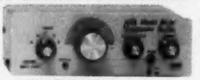

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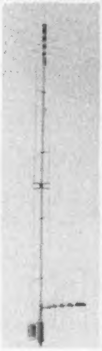

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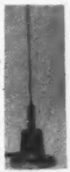

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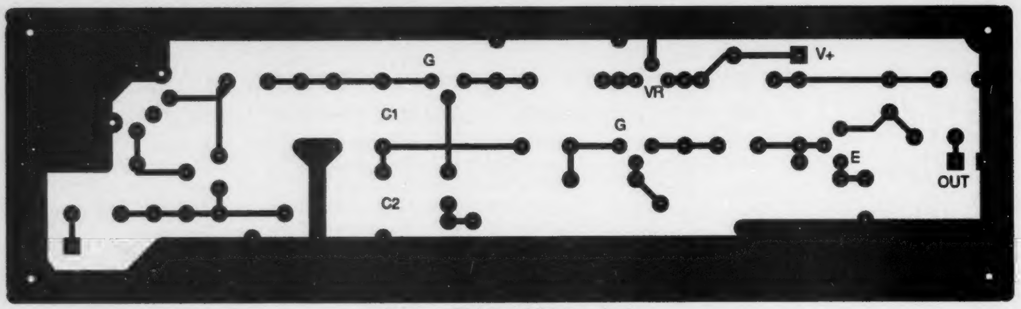

Figure 3. PC board foil pattern (1:1).

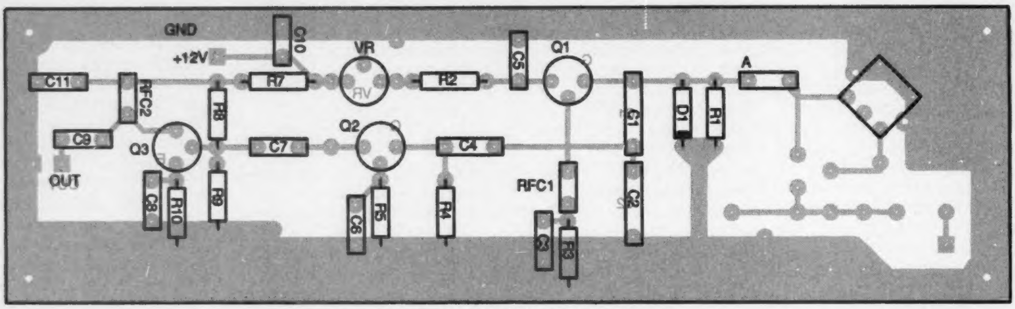

Figure 4. Parts placement for point "A" to the output.

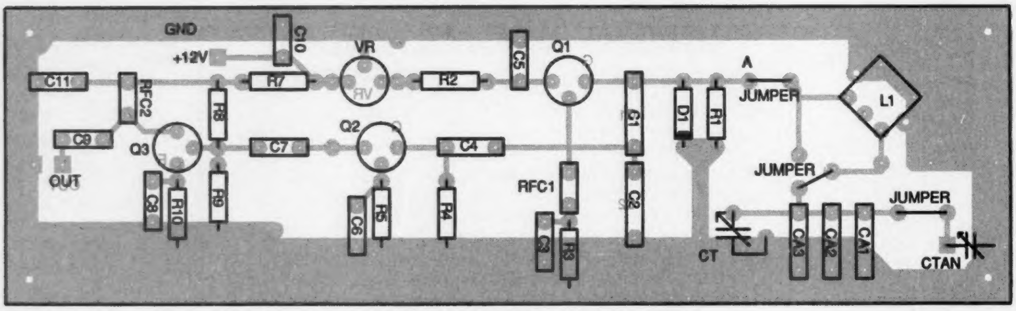

Figure 5. Parts placement with wiring for Clapp oscillator.

case. The total combination of all tuning capacitors should be about 200 ohms capacitive reactance, total. The feedback capacitors (C1 and C2) should have a reactance of approximately 50 to 100 ohms.

If you select the feedback capacitors (C1 and C2) incorrectly, then you may find either of two situations. First, the oscillation will abruptly cease at one or both ends of the tuning range. Second, the amplitude of the output signal drops to zero as the main tuning capacitor is tuned towards the high end of the range. All oscillators vary amplitude somewhat as the circuit is tuned, but when C1 and C2 are incorrect, the effect often drops rapidly as the main capacitor is tuned . . . reaching zero at some point.

There are two RF chokes used in this circuit (RFC1 and RFC2). The values shown are nominal values for high frequency applications, but variation will generally not harm the circuit's performance.

Figure 3 shows the foil pattern for the printed circuit board used with this project. You can make your own if you please, or order one for $14 either from me (POB 1099, Falls Church VA 22041) or from FAR Circuits (18N640 Field Ct., Dundee IL 60118). The parts layout for the printed circuit board is shown in Figure 4 for point "A" to the output.

The printed circuit board is set up for certain standard components. For RFC1 and RFC2, select components with 0.2" (5 mm) spacing between pins, such as the Toko size 8RB or 10RB coils. See the Digi-Key (POB 677, Thief River Falls MN 56701-0677; 1-800-344-4539) catalog for details on specific part numbers. Main tuning inductor L1 is selected from the Toko 10EZ, 10EZC, 10EZH, 10PA, or 10K size slug-tuned coils (again, see the Digi-Key catalog for part numbers for desired inductances). The trimmer capacitor, Ct, should be a 10 mm top-adjust type, such as the Sprague-Goodman FILMTRIM series sold by Digi-Key.

Configuring the printed circuit board for either the Colpitts or the Clapp oscillator depends on how the tuning components are wired on the board. Figure 5 shows the wiring for a Clapp (series-tuned) oscillator. The tuning capacitor, the trimmer and the fixed capacitors, plus inductor L1, are placed the same in both configurations. However, three jumpers are used in Figure 5 to make this circuit a Clapp oscillator.

Figure 6 shows the wiring for a Colpitts oscillator. One of the jumpers from Figure 5 is replaced with the DC blocking capacitor (Cc). The jumper from the fixed capacitors to the main tuning capacitor remains, and a new jumper is added from the bottom of L1 to ground.

Figure 7 shows the wiring for either Clapp or Colpitts cases where the tuning capacitor is series-connected with a small-value fixed capacitor. This configuration is often used for reducing the range of a variable capacitor to something required for a particular application. The total capacitance at any setting of the main tuning capacitor is:

$$C_{total} = \frac{(C_{BB})(C_{tun})}{C_{BB} + C_{tun}}$$

If you don't want to use the slug-tuned coil, but rather a toroid core inductor or air core inductor, then leave L1 off the board, and use the holes for the leads from the substitute coils.

Conclusion

This circuit makes a reasonable choice for many different VFO applications. It can be easily built, and is generally well behaved. Good luck. ■

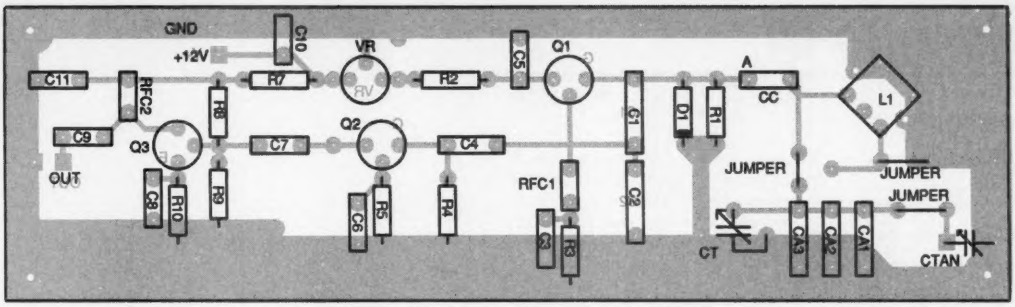

Figure 6. Parts placement with wiring for Colpitts oscillator.

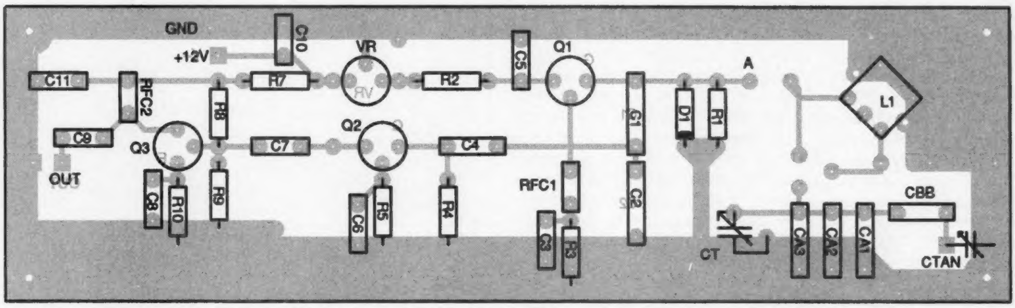

Figure 7. Parts placement with wiring for either Clapp or Colpitts cases where C_{tun} is in series with a fixed-value cap..

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Whether you want to play a musical instrument or pass a CW test, there is no substitute for diligent practice. The same goes for emergency preparedness. Both planning and simulated exercises are important for rapid, effective response.

After the January 17 earthquake in Southern California, ARES and RACES groups that had met regularly and held drills with their served agencies responded sooner and had greater overall success than groups that did not emphasize preplanning and operator training.

It takes practice to become skilled in radio direction finding (RDF) too. Hidden transmitter hunts (called foxhunts and T-hunts) are more than just fun—they are practical lessons in signal propagation, antenna theory, and navigation. They can prepare you for rapid RDF response in a disaster or other emergency.

Un-Jamming the Sheriff

JaMi Smith KK6CU is a District Communications Officer for the Los Angeles Disaster Communications Service (DCS). Following the quake, he took charge of the RACES room at the Sheriff's Communications Center (SCC) and the county's Emergency Operations Center (EOC) in East Los Angeles. Thirteen hours after arriving, JaMi was taking a short break from his volunteer DCS duties when a county employee, also on break, mentioned that a steady carrier had appeared on a county-wide law enforcement frequency.

KK6CU loves to go T-hunting, especially with his motorized VHF quad and storage scope display unit (see "Homing In" for October and November 1992). But he had traveled by motorcycle to the EOC, leaving his gear at home in Pasadena. Besides, the stuck transmitter was near 482 MHz, out of range for his UHF RDF quad. Figuring that he could hunt the carrier with a beam and his extended-range handheld, he asked if a yagi for 482 MHz was available. The answer was negative.

Minutes later, JaMi was approached by Sargeant Larry Bryant N6LYA, Officer in Charge at County Incident Command, along with a sargeant from the Communications Section. They told him that the interference was blocking a sheriff's administrative repeater that was vital for radio assignment requests and earthquake-related mutual aid communications. Of 37 receiver sites in the county, eight were picking up the signal. Vehicles and RDF gear were available. Could he help?

JaMi and the communications sargeant surveyed the SCC equipment pool, finding three OAR Corporation RDF display units, each with antenna sets. Two had built-in receivers that did not cover 482 MHz. The last unit was a nearly-new OAR Model DF4003A. This model does not include a receiver. Further search yielded a Model 2002A multi-mode scanner made by AOR (not to be confused with OAR).

The DF4003A (Photo A) has two connectors for receiver IF, plus an audio connector. The scanner has no IF output connector. No equipment manuals were handy, so JaMi decided to try hooking just the scanner audio to the RDF set. For this, he needed a cable with an RCA plug on one end and a miniature phone plug on the other. He quickly made one by cannibalizing a set of headphones and soldering its cable to a spare cable with an RCA plug.

The sargeant offered a choice of vehicles and an officer to drive. He and the radio technician strapped the Model MA350ED RDF antenna (Photo B) to the car top and put the rest of the gear inside. After a quick check of the setup using a hand-held transceiver, they took off. JaMi rode with the driver in front; the technician sat in the back.

The offending carrier was not copyable at the SCC, but signal levels into the receiver "voting" system led the county's technician to conclude that it was coming from the north end of the San Fernando Valley, perhaps from Sylmar (see Figure 1).

REDUCE
GAIN →
OAR
DF4003A
FOCUS
VERT POS
HORZ POS
INTEN
BEARING
HOLDING

Photo A. Government agencies are the main customers for Watson-Watt RDF equipment from OAR Corporation. This Model DF4003A display unit works with external receivers and antenna sets covering 1 through 520 MHz.

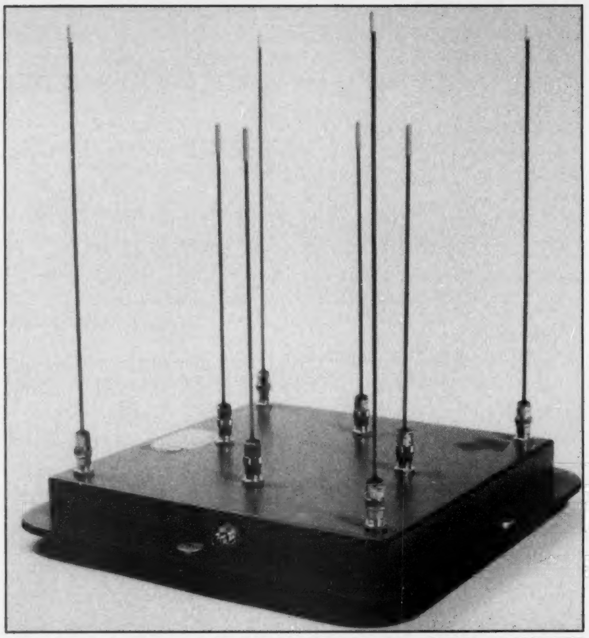

Photo B. It looks like a complex Doppler antenna, but the OAR Model MA350ED is actually two Watson-Watt arrays, a small one for UHF and a larger one for VHF.

Radio Waves and Ping-Pong Balls

UHF signals reflect from nearly any hard surface or object bigger than a breadbox. They carom off mountains, hills, buildings, billboards, and cars. The bearing on an RDF display tells the arrival direction of a signal, but in urban or hilly terrain this may not be the direction from which the signal originates.

When signals arrive at a receiver by both direct and reflected paths simultaneously, the effect is called "multipath." In severe multipath, an RDF

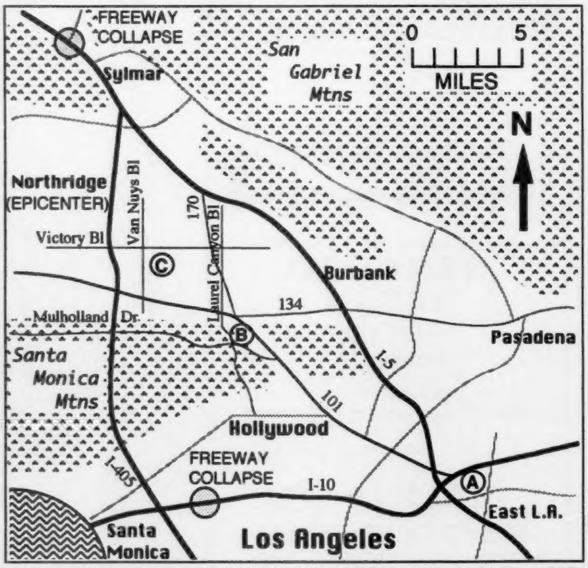

Figure 1. Starting from East Los Angeles (A), KK6CU went to the Hollywood hills for a clear bearing (B), then to the West Valley Administrative Center (C), where the stuck transmitter was found.

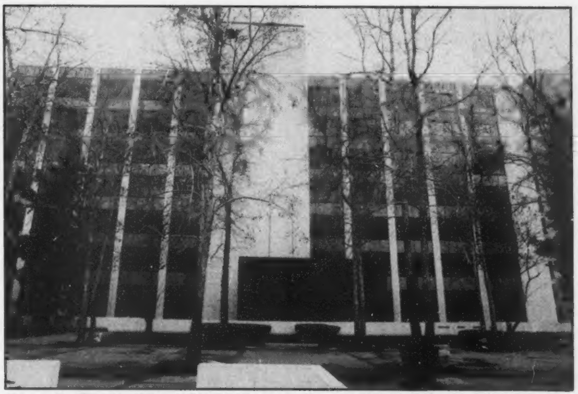

Photo C. The Northwest District Superior Court building is famous for being the site of the recent Menendez murder trial. Now it has another distinction—the source of a signal that jammed sheriff's communications after the Northridge earthquake.

bearing may change constantly, or be consistently wrong. From his T-hunting experiences, KK6CU knew that the best way to maximize the signal level and get an accurate bearing, with minimum multipath effect, is to be as high and in the clear as possible. He decided to immediately go to the top of the hills above Hollywood.

"On Mulholland Drive," he says, "there's a great spot that overlooks the San Fernando Valley. I've used it on T-hunts before. We headed up Interstate 5, then west on Highway 134 to Highway 101. All we could get was an occasional blip of signal on the RDF set. We had just gotten off 101, going south on Laurel Canyon Boulevard, when I got a strong bearing to the west as we waited at the light.

"I suspected a reflection, and it went away as we went south. But as we gained elevation, the signal came up again, mostly bearing to the north, because it's a box canyon. The hills were to the east and west. Once we got up on Mulholland, there was a steady bearing and virtually full-quieting signal. Before, we had gotten a lot of broadband noise. I could tell that because I have learned from experience to check by tuning off frequency to see if I am hearing noise or signal.

"We had no map and no compass, but I knew that the streets in the valley run north and south, so I looked down there for reference. The strong bearing was about about 290 degrees true, pointing toward the extreme northwestern end of the valley. The tech said he didn't believe it. He still thought it was to the north."

Back at Highway 101, the trio headed west at well above the speed limit. "A couple of miles west, we started getting signal again," JaMi went on. "Then the bearing started to change. I got a couple of strong due-north blips at the Van Nuys exit, but we still guessed we would have to go to the far end of the valley. By the time we got to Interstate 405, we were not getting good signal strength because we were below ground level. We decided to go north on the 405, and as we came up, I got good bearings east of us, swinging again. I told the driver to take the next exit. He locked up the brakes, swerved over, and we went east on Victory Boulevard."

JaMi and his companions were now only six miles from the earthquake epicenter. Power was out in most places, and a curfew was in effect. Fortunately, the driver was an officer in uniform.

Multipath makes UHF RDF in urban areas tricky. Rows of buildings tend to "funnel" signals down the streets. The bearing may appear to be constantly in front (or behind), and then change suddenly at an intersection. "As we approached Van Nuys Boulevard, the bearing tended toward south," KK6CU continued. "Now the signal was full quieting and I could hear the DF tone plainly in the receiver audio.

"I had the driver pull out into the intersection very slowly. There was a lot of multipath and the display swung around quite a bit. I told him to continue east, and at the next street we went out in the middle again. It looked to be to the south, so we turned south for three blocks and found ourselves inside a large complex of government buildings, including two courthouses and the Los Angeles Police headquarters for the San Fernando Valley."

They headed for the police mobile command center, where JaMi got out and checked by the vehicles with his dual-band hand-held. No stuck mikes there. Back in the sheriff's car, they drove around the complex. Signal was weak everywhere except on the south side of the Superior Court building. They parked again and walked all

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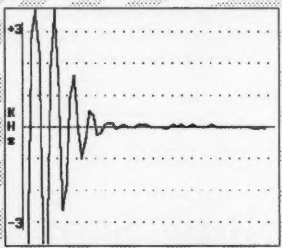

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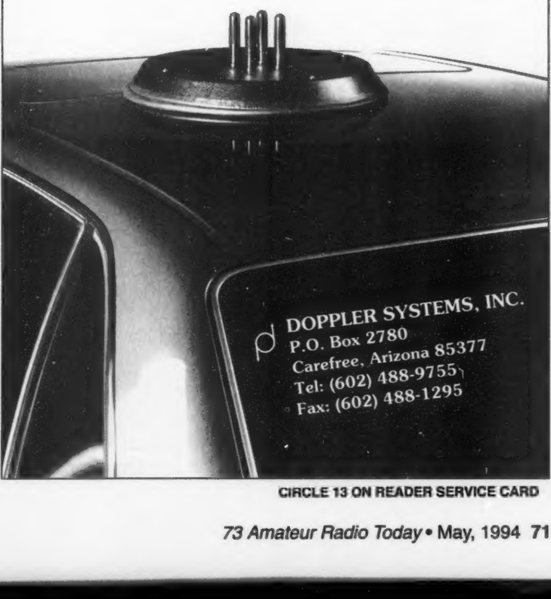

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around, seeing no one but noting boarded-up doors and other signs of damage.

After walking back next door to the police station, they introduced themselves and KK6CU checked for signal inside the building. Meanwhile, the technician found out that a sheriff's radio set had been installed in the Superior Court building a year ago. Back they went to that courthouse (Photo C) to peer into the windows again.

"Finally, we saw somebody inside," says KK6CU. "It was a plainclothes deputy assigned to guard the building. He let us in and we asked directions to the communications room. There we found that the ceilings were wet and there was water all over the floor from leaking pipes. There was an old desk with stacks of paper around the edges of the desktop, which was sagging in middle. Water was a half inch deep in center, and an old desk mike sat in the middle of the pool, with the push-button switch submerged. I carefully pulled it out, shook it dry, and the carrier disappeared!

"We were still in a period of strong aftershocks, so we decided to get out of there right away. To be safe, we unplugged it and a few other pieces of equipment that were saturated. I disassembled the DF gear and we headed back to the SCC."

The submerged mike was connected to a 100-watt transmitter. So why was the signal so weak until the T-hunters were within a mile of the courthouse? It turned out that this radio is used mainly for communications within the building on simplex frequencies. The transmitter drives a long run of special "leaky" coax that goes up the south side of the building to a dummy load. Enough signal escapes from the coax to reach the officer's transceivers inside for simplex work. The signal can also be heard by the sensitive sheriff's repeater network when the transceiver is switched to the administrative frequency, which the marshal had apparently done at the end of the last work shift before the quake.

Despite unfamiliar equipment and a weak signal, KK6CU and his helpers found the problem and fixed it in less than an hour. Without JaMi's understanding of RDF principles and his practical foxhunting experience, it would have taken much longer.

Introducing the Watson-Watt

OAR (which stands for Ocean Applied Research) is a well-known name among commercial and government users of RDF equipment. T-hunting hams seldom buy OAR gear, due to its cost. Sticker price of the DF4003A plus a basic antenna system covering 2 meters (MA350) is $11,700.

Why so much? After all, you can buy an excellent commercial Doppler RDF unit with digital readout and 2 meter mobile antenna set for about $850. You can build the popular and effective Roanoke Doppler from scratch for much less. The reason for the price difference is that OAR units do not employ the Doppler principle, even though they have four vertical whips and put a tone in the receiver audio, just like a Doppler set does.

OAR sets use the Watson-Watt RDF scheme, which is derived from the Adcock, one of the earliest RDF antennas. Whereas a Doppler rapidly selects one of the four (or more) whips at a time in sequence to give an electronic rotation to the array, a Watson-Watt uses the four antennas as two orthogonal pairs, combining signals from them in three distinct modes. Processing these modes produces a vector on the cathode-ray tube display. The vector position tells direction of the incoming signal. Vector length indicates signal strength and quality, helping the operator detect and combat the effects of multipath.

One reason for the high cost of OAR gear is its special three-channel processing, which makes one receiver do the work of three. Some OAR models include a built-in receiver, while others work with an external receiver or scanner. Unlike the Doppler, which uses ordinary narrowband FM receivers, the Watson-Watt signal processor requires AM detection. Direct connection of the processor to the receiver IF stage allows normal use of the receiver for monitoring in any mode. If the receiver does not have an IF tap, the OAR DF4003A can be hooked to receiver audio output, but the set must be kept in the AM mode.

There is no RF switching in the Watson-Watt antenna array, which can result in better system sensitivity than Doppler installations. OAR sets include a track-and-hold feature for capturing very short signal bursts, and integration of bearings over time to average out multipath effects while in motion. Doppler sets are usually limited to tracking carrier-type signals such as FM and CW, whereas the Watson-Watt method tracks all these plus SSB and pulsed noise sources.

For More Information . . .

OAR's manufacturing facilities are in San Diego, California, but the primary sales office is on the East Coast: OAR Corporation, 2165 Druid Park Drive, Baltimore MD 21211; (410) 462-1700.

Plans for the Roanoke Doppler are in the book *Transmitter Hunting—Radio Direction Finding Simplified*, available from your local bookstore. This book also includes a comprehensive discussion of both Doppler and Watson-Watt RDF techniques. ■

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Self-Esteem: The Key to Success in School and in Life

With parent-teacher conferences scheduled to take place at my school this month, I thought about all the things I wanted to convey to the parents of my new sixth-, seventh-, and eighth-grade ham radio students. I made a package of brochures of inexpensive rigs and radio accessories that I could show them. Besides sharing individual students' progress with each parent, I planned to give my usual "propaganda" speech for ham radio. This was quite ambitious for what was supposed to be a two-minute conference with a parent.

I thought back to how much the children in my classes have changed over the last 10 years. As the largest intermediate school in Staten Island, New York, we have seen a huge change in the population of our students. We presently have over 80 different languages and dialects represented; creating a need for a full-time ESL (English as a Second Language) teacher. Many of our students come from low socio-economic backgrounds, bringing with them a whole different set of problems which could interfere with the learning process.

The problems facing teachers in inner-city schools today are varied and complex. They cannot be ignored for they will surely not go away by themselves. The one common thread that seems to run true year after year of dealing with this difficult age group is that they all respond to respect and genuine caring. I filed my radio brochures away and dug out some articles I had saved to read that were published by The National PTA. I found the one I wanted, and proceeded to run off 100 copies of it. I plan to share it with my colleagues and to distribute it to the parents who come to see me to discuss their child's progress.

Without helping children to develop self-esteem, we will inevitably fail at whatever other good things we try to teach them. As a parent and as a teacher I encourage you to include the following in your repertoire of important things to teach your children, along with rules of radio procedure and Ohm's Law, etc.

Studies have shown that helping children develop good self-esteem is probably the most important thing parents and teachers can do for their children. Critical decisions, such as whether or not to use drugs, or to stay in school or drop out, are affected by their sense of self-worth—their self-esteem.

15 Ways to Help Children Like Themselves

1. Reward children. Give praise, recognition, a special privilege, or increased responsibility for a job well done. Emphasize the good things they do, not the bad.

2. Take their ideas, emotions, and feelings seriously.

3. Define limits and rules clearly, and enforce them. Be consistent.

4. Be a good role model. Let them see that you, too, can make mistakes and can learn from them.

5. Teach children how to deal with time and money.

6. Have reasonable expectations for your children and your students. Help them set realistic goals so they can experience success.

7. Help children develop tolerance toward those with different values and backgrounds. Point out other people's strengths.

8. Give children responsibility. They will feel useful and valued.

9. Be reasonable. Give support when children need it.

10. Show them that what they do is important to you. Talk with them about their activities and interests. In the case of radio students, ask them to tell you what they enjoy most about the hobby.

11. Express your values. Describe experiences that determined your values, and the reasons behind your beliefs.

12. Spend time together. Share favorite activities. Ham radio is great for this.

13. Discuss problems without placing blame or commenting on the child's character. If children know there is a problem but don't feel attacked they are more likely to look for a solution.

14. Use phrases that build self-esteem, such as, "That was an excellent idea." Avoid phrases that destroy self-esteem, like "How many times have I told you?"

15. Show how much you care about them. Tell them you think they are terrific. Use body language, smiles, and words that make children feel good to let them know that you are interested in them as people and that you have something really special to share with them. Many youngsters have told me that they originally got their radio licenses because they wanted to make me proud of them.

As responsible adults working with children, we owe it to them, and to each other, to make every child feel special and worthy so that they can become happy, productive members of society.

Be sure to stop by at the Dayton Hamvention Youth Forum on Saturday, April 30th, to lend your support to all the youngsters who will be speaking there. We've got a terrific group of children lined up. ■

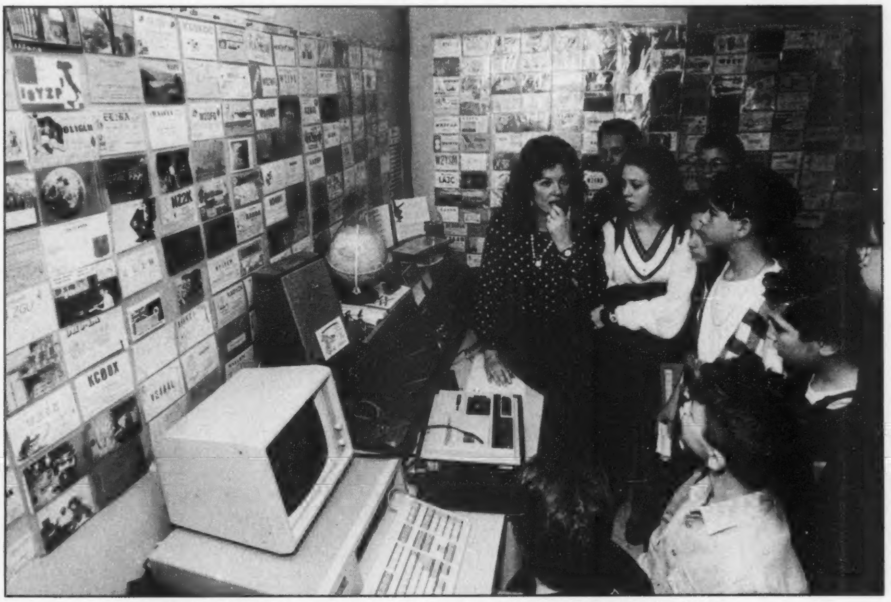

Photo A. Ham radio provides a great opportunity to share interests and activities.

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QRP

Low Power Operation

Michael Bryce WB8VGE
2225 Mayflower NW
Massillon OH 44646

Have you been looking for a good analog meter for a project? Have you found out how much they cost? One would think, with the entire world going digital, analog meters would be really, really cheap. The exact opposite has occurred instead. Now, a quality analog meter costs more than the project you're trying to construct. You can still find plenty of surplus analog meters laying around however, provided you don't mind the face printed with some strange industrial scale.

Entering the Digital World

This is a case of "if you can't beat 'em, join 'em" as digital panel modules are now available at a very reasonable price. I've have been working with two different models from two different suppliers.

They're both low power 3-1/2 digit LCD digital panel meters. Their basic input requirement is 200 mV DC. Other input ranges are also possible, by special order. The first module we'll look at is the D1 International DPM5035L. The second module is by Modutec.

Specifications

The DPM5035L is built around a Maxim MAX131CPL analog-to-digital converter chip. Along with some support parts, the Maxim chip does all the work. The LCD is an easy-to-read 0.5" high and shows 3-1/2 digits. Automatic zero and a polarity indicator are part of the DPM5035L. You can select your own decimal point position. A "1" displayed on the left-most side of the DPM5035L is the over-range indication. The conversion rate is about three times per second.

The DPM5035L has a basic DC input of 200 mV. The input is differential. Input impedance is over 11 megohms. You can operate the DPM5035L on a single 9 volt battery. Any power supply from 5 to 9 volts will work just fine. The low battery indication comes on at approximately 4.8 volts. According to the factory, a fresh 9 volt battery should operate the DPM5035L for over one year. If you want, or if you just don't need the LCD display, you can also order the DPM5035L in an LED-readout version. Its number is DPM5135. This LED version requires 5 volts at less than 130 mA. This would be an ideal DPM for a power supply. Both the DPM5035L and the DPM5135 are available from D1 International Inc., 95 East Main Street., Huntington NY 11743; (516) 673-6866. The price for the DPM5035L is about $30, plus shipping.

The Modutec digital panel meter is so very close to these specifications I won't repeat them. The Modutec DPM I used is the BL100101. You can get this meter from Digi-Key for $33. While it has the same LCD, 0.5", and displays 3-1/2 digits, the Modutec DPM is much smaller than the DPM5035L. In fact, you can place the Modutec DPM inside the D1 International DPM.

Differences Between the Two

Both of these DPMs are very much alike electrically; the main difference is in their physical layout. The DPM5035L is the larger of the two and requires much more panel area than the Modutec DPM. This may be of concern if you're wondering about using one of these DPMs in your next QRP project. Although larger, the DPM5035L is much easier to install. The DPM5035L snaps into the panel cutout. No other hardware is required. This bezel allows for some "operator error" when cutting out the panel. The Modutec DPM, on the other hand, requires a very clean-fitting cutout. There is no bezel to hide your mistakes. The Modutec meter also requires you to add a mounting clip and plastic nuts. It's no biggie, but you have to really take your time to do the installation properly with the Modutec DPM. The Modutec meter also requires a connection kit. This kit is a header on 0.100 centers. The input to the Modutec meter is very sensitive to static discharges and you are warned not to solder directly to the DPM pins. Use the connection kit to avoid problems.

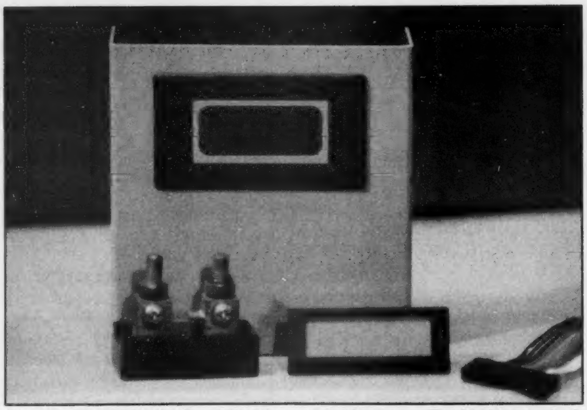


Photo A. The D1 Digital Panel Module mounted in a case. The Modutec meter is in the foreground with its connector. A 100 amp 100 mV shunt is also shown.

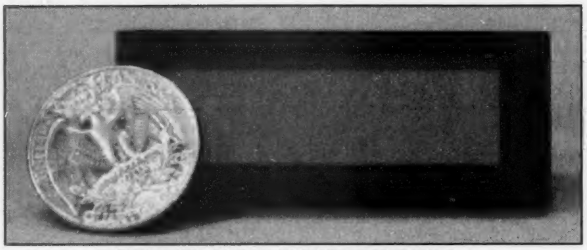
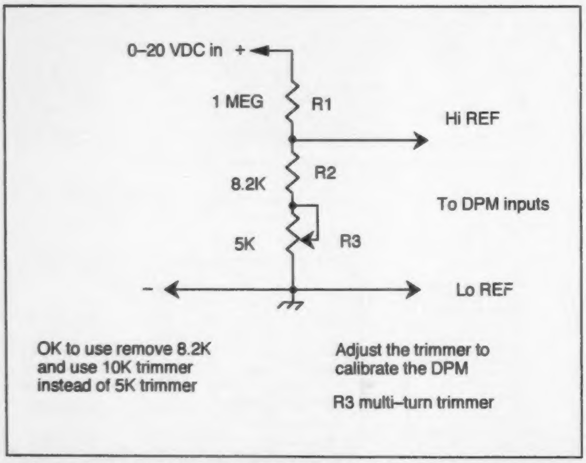


Photo B. The Modutec Digital Panel Module is tiny.



OK to use remove 8.2K
and use 10K trimmer
instead of 5K trimmer

Adjust the trimmer to
calibrate the DPM

R3 multi–turn trimmer

Figure 1. Input circuitry to properly scale the ratio of signal to input for the DPM.

Making Them Work

A very popular use of the DPM is to measure voltage from a power supply or a battery. The first step you need to do is scale the input so the DPM knows what to do with it. With an input of only 200 mV, it becomes quite clear you must keep the proper ratio of signal to input. Take a look at Figure 1. You'll notice that the two resistors scale the input from our power supply down to a value the DPM needs. We have scaled the 200 mV input to 20 volts input. In case you don't have 1% resistors on hand, I added the 10k trimmer to fine-tune the voltage divider. An 8.2k and a 5k trimmer provide an easier adjusting of the DPM.

By changing the values in the voltage divider, while keeping the ratio the same, you can scale the input to just about any value you require. The only precaution would be to increase the number of resistors in series when measuring very high voltages. This would prevent flash over of a single resistor. Of course, you QRPers don't need to worry about measuring kV in our amplifiers—unless you happen to smoke cigars!

Trouble with the Input

If you look close at Figure 1, you'll see there is a second power supply running the DPM. That's because you can't have the Lo REF tied to ground. This causes the A-to-D converter chip inside the DPM to become confused and display a false reading. There is only one way around this problem. You must have a separate power source to operate the DPM. Luckily for us, we have three choices. The first is to use a 9 volt battery. It's simple, cheap, and sure is easy. The second is to operate the DPM from a separate power source such as a wall wart power supply. Or, we can use a DC-to-DC converter.

You can buy commercial DC-to-DC converters just about anywhere. But, hold onto your hats, they're not cheap! The one D1 International sells to operate their DPM runs about $20. It generates a +9 volt supply which is totally isolated. I've seen DC-to-DC

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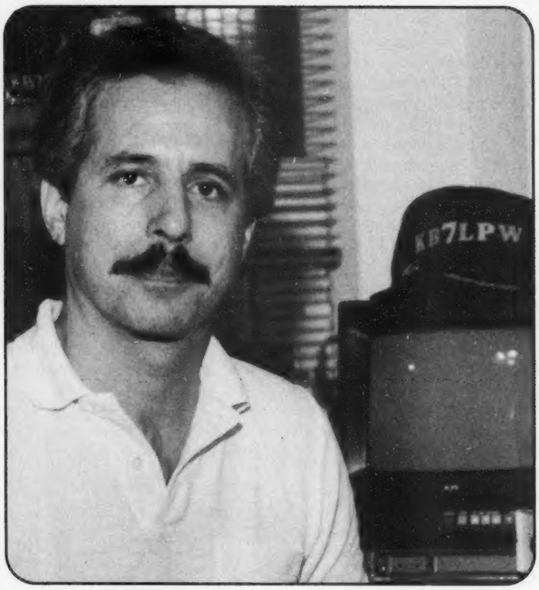

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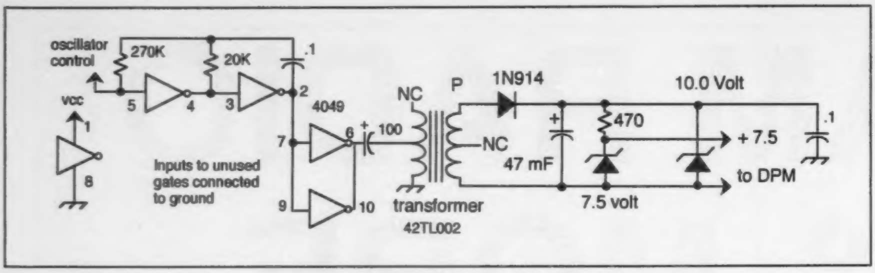

Figure 2. DC to DC converter for the DPM.

converters listed in surplus catalogs. One had a converter that would fill the requirements for under two bucks. It is important when shopping for a converter to get one that supplies an isolated +9 (or +5) volts. Some voltage converters generate a different voltage than the supply. This is not what you want for the DPM.

You can roll your own DC-to-DC converter without too much trouble. In fact, all you need is just a spoonful of parts. Figure 2 shows the DC-to-DC converter I built up using some junk box parts. The output from the oscillator is coupled to a small transformer. The output is then rectified, filtered and regulated to 7.5 volts with a zener diode and a resistor. A second zener diode is also across the output of the converter. This diode acts as a safety valve in case the 7.5 volt zener opens up. If that happens, the 10 volt zener will short the output together, protecting the DPM from overvoltage. In my DC-to-DC converter there is very little current developed. Although I've never measured it, I would guess the total amount of current generated would be less than 10 mA.

Just about any type of oscillator can be used in this circuit. I've used a single gate of an LM324, a 555 timer, a 4049, and at least several others, too. In fact, nothing is really critical. The driver transformer is available from Mouser Electronics.

Notice how the output is separated from the supply ground. This gives us the required isolation. The 0.1 µF capacitor from the output to system ground was required to keep a nasty spike from confusing the DPM.

I built this converter on a hunk of perf board. There is no PC board layout for it. Since the converter uses an oscillator, it may be possible to hear this oscillator in your receiver. Some careful shielding of the converter will keep all the noise inside and out of the receiver.

If you suffer from inductorphopia, you might be able to come up with a suitable DC-to-DC converter without the transformer. Perhaps some types of capacitance-coupled diodes may work.

Measuring Current with the DPM

There is one more task the DPM is capable of doing: It has the ability to measure current. All you need is a shunt in the negative lead and you're ready to go. If you use a calibrated shunt the display will be accurate; if you use a homemade shunt you'll need to calibrate the meter.

A laser trimmer 100 mV shunt is what I use. This shunt will drop one millivolt for every amp of current. So, at 100 amps, we have 100 mV across the shunt. If this is applied to the DPM, the display will be 100. You can select the display decimal point by using a switch. At 10 amps, the display would read 010 and so on. It is important that the shunt be in the negative lead. And again, the DPM must be running on either a battery or the DC-to-DC converter described above. I have a source of laser trimmer 100 mV shunts. They're not cheap, about $35 each, but if you're interested, drop me a note.

Depending on the amount of current you want to measure, you can build your own shunt. A six-inch piece of solid #14 copper wire wound on an AA battery works great. Use the battery as a form only; remove it before you use the shunt. You have to calibrate this shunt with a 100k-to-470k trimmer as shown in the schematic. Either value will work. To calibrate the shunt, first connect a load of several amps in series with a source of power and the shunt. A headlight makes a cheap and dirty load. Now install your own current meter, say your multimeter, in series, too. Turn on the supply and note the current on your multimeter. Adjust the trimmer so the DPM displays the same value. Place a drop of paint or nail polish on the trimmer to prevent its movement and you're all done. By using a shunt and the DPM, you have a great way to measure a large amount of current safely. A multi-pole switch would be ideal for a combination voltage and current display.

Other Uses

Although the DPM is really at home with current and voltage, it can be made to do other tasks. If you want to display frequency, for example, all you have to do is add a frequency to voltage chip and display the results on the DPM. Measuring SWR or RF power would be easier yet. Two of the DPMs, one to measure forward power and a second to measure reflected power, would be easy to build. In fact, the Kanga power bridge would be a good test bed for a project like this. Right now, I'm working on my own version of a field-strength meter using the DPM from D1 International. Should be an interesting project to build.

Field Day

Next month is Field Day, a traditional outing for QRP stations. How about getting those Field Day photos together and sending some in? Other QPRers would like to see what the guy's station looks like after the smoke clears.

While life may be too short for QRP, intense levels of RF and those cigars will do you in quicker! ■

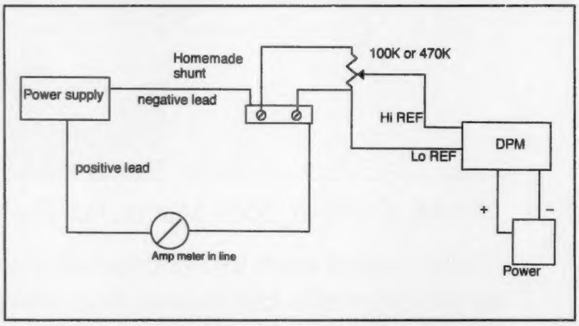

Figure 3. Using a power supply to calibrate the DPM to read current.

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Getting Started in TCP/IP, Part 7

From Here to There—Routing and TCP/IP

This month's installation of our TCP/IP series will concentrate on routing, the specification of the path that traffic should take between stations.

If I want to connect to your station, but cannot hear it directly, I am not out of luck. The TCP/IP protocol offers the ability to create "routing tables" which specify how traffic addressed to a particular station should be directed. TCP/IP uses what is called "static routing," that is, it depends upon the tables you create to find the intended station for a given address.

ARP

ARP means Address Resolution Protocol, and this is the TCP/IP service that lets JNOS figure out what you mean when you save N1EWO.AMPR.ORG. Let's follow a hypothetical connection by you to my station. We'll use the ttylink (chat) program so we can talk. The first step is for you to type the proper command at the prompt:

```
59872 net>tty N1EWO
```

This tells JNOS to make a telnet connection to port 87 of my station—which is the ttylink service. The first thing your station does is make an ARP request on the air. If we switch to the monitor screen (by pressing F9) we see:

```
AX25: (your call) ->QST
      UI pid=ARP
ARP:  len 30 hwtype AX.25 prot
      IP op REQUEST
sender IPaddr 44.(your IP
address) hwaddr (your call)
target IPaddr 44.48.70.22 hwaddr
```

Your station is asking the world, "What is the hardware address of 44.48.70.22?" What is a hardware address? TCP/IP is network layer protocol, and in the ham radio world it runs over an AX.25 (plain old packet) link. We use the AX.25 link to create the connection between stations—we use TCP/IP to manage and control data between stations. So, the hardware address is whatever "mycall" is set to for a TCP/IP station. The purpose of the ARP request is to find out what that call is, so communication can take place. TCP/IP is a "datagram" protocol. This is in contrast to a "virtual circuit" protocol such as AX.25. In other words, data transfer via TCP/IP on ham radio is accomplished with AX.25 UI (Unnumbered Information) frames—in plain language, the stations never connect in the AX.25 sense.

> **"This month's installation of our TCP/IP series will concentrate on routing, the specification of the path that traffic should take between stations."**

By way of example, if we were using NOS over an Ethernet network instead of AX.25, the hardware address that would be sought by the ARP request is the MAC (Media Access Control) address. This is an eight-byte address that is unique to an Ethernet NIC (Network Interface Card), just as "mycall" is unique to an AX.25 station.

Let's assume that my station can hear your station directly. I hear your ARP request and reply (again in the monitor screen):

```
AX25:     N1EWO -> (your call)
          UI pid=ARP
ARP:      len 30 hwtype AX.25
          prot IP op REPLY
sender IPaddr 44.48.70.22
hwaddr N1EWO
target IPaddr (your IP
address) hwaddr (your call)
```

As you can see, my station sent a REPLY to yours indicating that my hardware address is N1EWO. It could have been N1EWO-1 or some other SSID (Secondary Station IDentifier, the -1 part). Or, what if I couldn't hear your station—is all lost?

No, there are at least a couple of ways around that. First, I could fix things from my end by arranging a "gateway" and having it "publish" itself as the hardware address to reach me. To make this work takes two steps. First I must use the ARP command (at the gateway station) to publish itself as the hardware address for my station:

arp publish 44.48.70.22 ax25
(gateway hwaddr) (interface)

where:

44.48.709.22 is my address
ax25 is the hardware type
(gateway hwaddr) is the call of the gateway
(interface) is the name of the interface on the gateway that will publish this address.

Now an ARP request for my hardware address will be answered by this gateway station. Trouble is, if I do nothing else this doesn't let us communicate. I need to tell the gateway where to send the traffic that it gets for me. I do this with the ROUTE command:

route add 44.48.70.22 (interface)

Now traffic sent to this station will be sent out the interface specified.

Alternatively, you can set it up from your side. This works by manually adding my station to your ARP list:

arp add 44.48.70.22 ax25 N1EWO
(interface)

which puts a permanent entry in the ARP table for me. The second step in this process is to add an AX.25 route to my hardware address using the ax25 command:

ax25 route add N1EWO (interface)
(digis . . .)

This puts an entry into the AX.25 routing table for my hardware address, letting you connect. The ARP entry means that you don't have to send out a request—which I could not hear. You can see that TCP/IP routing is "static"—you set it up and then must change it manually. If you can hear the stations directly, it is dynamic (you ask, it tells, your tables are built), but not otherwise.

Next month we'll look more at routing. 73 de N1EWO.

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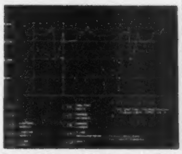

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ATV Birthday Party

Kim Cohan KD6TLB wanted his 30th birthday party to be unusual and unique. Since he is a pilot and also loves ATV, he decided to combine these interests and throw a truly amazing aerial celebration that the locals would keep talking about.

After a lot of coordinating with the FAA and local airport officials he was able to arrange to have four skydiving instructors from the Hollister airport parachute from an altitude of 11,000 feet to land right in his back yard (fortunately he lives right next to the Carmel Valley Airport). To make this a truly memorable experience, he enlisted the aid of some of the members of the Naval Postgraduate School ARC in Monterey to work out a way of televising the jump live via ATV.

Skydiving TV

Doug McKinney KC3RL designed a small knapsack 1 watt ATV transmitter that strapped around the waist of the skydiver. The transmitter consisted of a Kreepie-Peepie transmitter (P.C. Electronics), an audio ID that sent out a CW message over the ATV audio subcarrier and an eight-cell AA alkaline battery pack mounted in a sturdy metal enclosure (Bud CU-247 or Hammond 1590D). Doug found that by using an alkaline AA pack he could keep everything lightweight and compact and still operate the system for around four hours. One unique feature that Doug designed into his ATV box was a latching ON/OFF toggle switch. Once turned on, you need to lift up the toggle and physically slide it over to allow it to snap off. It is virtually impossible to accidentally brush against this switch and move it. Anyone building up a portable ATV system may want to incorporate this switch into their design. It is available from Digi-Key (part number CKN1015-ND) and is made by C&K Company (called the K-locking lever).

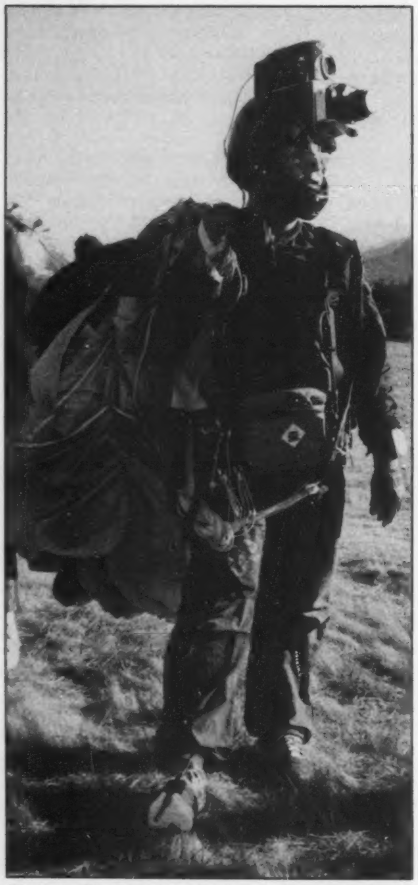

Photo A. Skydiver Jess Rodriguez demonstrates his unique helmet camera system complete with ATV transmitter. An 8mm camcorder and a 35mm film camera is mounted to his helmet via an aluminum bracket. The ATV transmitter is strapped to his waist inside of the knapsack and the ATV antenna can be seen attached to his shoe.

Finding a good place to attach the antenna to the skydiver presented an interesting problem for Doug. He tried taping a 440 MHz rubber duck antenna to the skydiver's shoe but found that this caused problems due to detuning. To solve this problem, Doug formed a 2"-thick urethane spacer out of "Great Stuff" spray foam (found at most hardware stores). He mounted the rubber duck on top of the foam and carved out the bottom of the foam so that it rested on top of the skydiver's shoe. RG-58 coax was run from the transmitter down to the antenna underneath the skydiver's flight suit (it's important to keep cables from tangling up with the other skydivers in the plane prior to jumping). This arrangement allowed the skydiver complete freedom of movement without the danger of tripping over cables or the antenna during landing.

The Skycam Helmet

It turned out that Jess Rodriguez, the skydiver chosen to carry the ATV system, had already developed his own system for videotaping his flights (see Photo A). He had an 8mm camcorder strapped the top of his helmet and a mechanical sight that he could place in front of one of his eyes. All he had to do was to line up the sight with whatever scene he wanted to videotape (important for filming formation skydiving). Interfacing the camcorder to the waist-mount ATV transmitter simply involved running a small cable behind the helmet and under his jacket.

Taking a Fall

To receive the signal, Mike Marchini WA6EOC, Pat Carter KA6IRS, Steve Bible N6HPR and Don Nichols KB6BZL set up a ground station under a tent on the edge of the Carmel Valley airport. Mike and Pat also recorded the flight on their VCR. We all crowded out onto the airport and could just make out a tiny speck moving across the sky. Using a six-element beam we started to receive an excellent ATV picture showing the inside of the jump plane as it circled overhead at 11,000 feet. Soon we could see several small dots as the skydivers jumped out of the plane. Everyone crowded around the TV set, and all were amazed to see a beautiful image of the skydivers linking hands and free-falling in formation. The helmet camera provided a very stable image that gave us the illusion that we were up there free-falling with them. One by one they opened their steerable parafoils and treated us all with an aerial tour of the Carmel Valley as they gently descended towards the airport. As the skydivers landed in front of us, each shouted out "Happy Birthday" to Kim, folded up the chute, and joined the party.

The Ultimate Birthday Balloon

As if skydiving ATV wasn't enough, we launched an ATV balloon (with color camera) about an hour after the skydiving adventure. This package contained a lightweight color TV camera (Howard Associates, Thousand Oaks, CA), a 5 watt ATV transmitter on 434 MHz (micro-ATV transmitter with a P.C. Electronics PA-5 power brick) and a GPS system on 2 meter packet built by Doug McKinney KC3RL. We launched this package just a couple of hours before sunset and treated the party-goers with an aerial view of the mountains as the balloon drifted up into the stratosphere. The chase crew was deployed near the impact zone (about 50 miles southeast of the party) but darkness and the remote landing site prevented a recovery that night. Thanks to Kim's eagle eyes, he spotted the payload a few days later while flying over a ranch in the foothills east of King City in his Cessna 150. After fending our way past a few herds of cattle we were able to recover everything in good shape.

Photo B. The birthday guy, Kim Cohan KD6TLB, looks on as Jess Rodriguez and his Skydive Cam prepare to land at the party.

The party continued on with even more unique events such as a MIDI concert that involved a pianist in Ohio (Eugene Beer) playing Kim's synthesizer in California via a telephone modem and a paper glider contest (dropped from a tethered balloon). Kim's party was truly a multimedia affair and sparked an interest in ham radio with several of the guests. We're all looking forward to next year's event—I guess it'll have to be a virtual reality ATV party to top this one!

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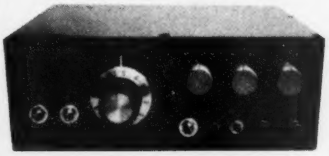

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PD-440N	420-450 Mhz	"	NO	Linear	1/2 OR 4-5W = 18W	T/R	119
PD-440N	420-450 Mhz	"	YES	"	1/2 OR 4-5W = 18W	T/R	143
PD-440N-1	"	"	NO	"	1/2 OR 4-5W = 35W	T/R	155
PD-440N-1	"	"	YES	"	1/2 OR 4-5W = 35W	T/R	179
PD-440N-2	"	"	NO	"	1/2 OR 4-5W = 60W	T/R	285
PD-440N-2R	"	"	NO	"	3-4W = 60W		199
PD-440N-3	"	"	NO	"	3-4W = 60W	T/R	235
PD-440NM	"	"	NO	"	1/2W = 6W		75
PD-440NM	"	"	NO	"	1/2W = 6W	T/R	118
PD-900N	902-928 Mhz	"	NO	FM	1/2W = 10W		65
PD-900N	902-928 Mhz	"	NO	FM	1/2W = 10W	T/R	90
PD-33LHP	902-928Mhz	"	NO	Linear	1W = 18W		265
PD-33LHP	902-928 Mhz	"	NO	"	1W = 16W	T/R	299
PD-33LP	"	"	NO	"	1W = 6.5W		119
PD-33HP	"	"	NO	"	6W = 15W		125
PD-33VLP-1	"	"	NO	Hybrid	5mw = 8W		123
PD-33VLP	"	"	NO	Linear	1/2W = 1.5W		59
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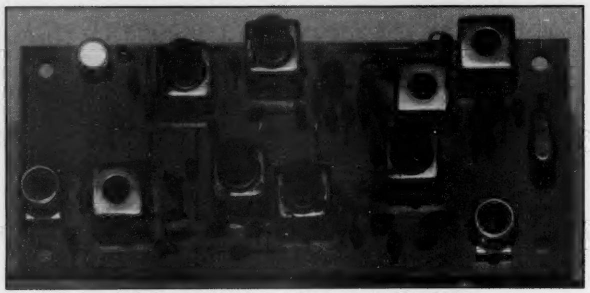

Photo A. Hamtronics receive converter CA-144-28.

C. L. Houghton WB6IGP
San Diego Microwave Group
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Constructing Hamtronics Modules: Conversion of 28 MHz HF to 2 Meters SSB

Last month in this column I covered a basic concept; one method of converting an SSB HF rig using a VHF transverter, adapting an HF rig to 2 meter SSB operation. I detailed the HF modifications to my test device, an Atlas R-100 SSB HF rig. I used this rig because it was available to me for a modest cost. The basic point is that any inexpensive HF rig you locate is usable if it can cover the desired frequency range, in this case 10 meters (28 MHz). 10 meters is just a platform for generating and receiving SSB in this particular application. Any similar rig will work as it has all the basic circuitry to accomplish this goal. Whatever type of HF rig you base your design around you should be able to find a bargain in the used equipment or swap meet arena. Obtaining a used HF rig for this project and converting it makes good sense from both a time-saving and monetary point of view, in contrast to home construction of an SSB system for this use.

Using a Hamtronics Kit

As I stated last month, 1 selected the Atlas-R-100 receiver as the basis for my 28 MHz SSB portion because its circuitry is constructed to work in transmit or receive functions simply using a single PC board design. See the April "Above and Beyond" column for details. This month I want to cover the construction and interfacing of the Hamtronics transmit and receive modules to convert a 28 MHz SSB transceiver to 2 meters. Initially I was going to design a set of modules for this purpose but when I read the Hamtronics advertisement for their modules and looked at the cost, I could see this was a better deal than trying to re-invent the wheel. Besides, it's more fun to put a kit together than to engineer one.

Let me give you a few excerpts from the Hamtronics construction details that come packed with their equipment to give you an example of how easy they have made interfacing their kits. This excerpt is only a portion of the information supplied and deals with the attenuator needed for the transmit side of the circuit. See Table 1 for resistor selection values to construct a suitable attenuator.

There are many ways to come up with 1 milliwatt of drive at 10 meters. It is not possible to cover every example for each type of exciter, but the general information provided should be adaptable for your particular situation. The primary things to remember: First, be very careful to start on the conservative side when experimenting to find the best value to use. If you apply a massive amount of power to your converter you may end up with *smoke signals* instead of SSB signals. Second, do not reduce the audio gain of the exciter to keep output drive low, except for fine adjustment. Design your attenuator to use the full range of the exciter. Then you won't *blast* the transceiver accidentally with high power when the converter is in operation. Third, be prepared to experiment to find the ideal attenuator for your situation.

For low-power radios (less than 5 watts), you can simply build a symmetrical pi-attenuator to reduce drive for the converter. Mechanically, the attenuator is made of composition resistors of appropriate rating (be conservative) soldered to a vector board or terminal strip. Keep connections short and install any convenient length of coax cable and connections to complete the job. See Table 1 for attenuator values. It is sufficient to find resistance values close to the values given—it is not necessary to be exact! Make sure the resistors can handle the power level safely, especially the shunt resistor on the exciter side of the circuit, which dissipates most of the power.

The above description was part of the 11 pages of detailed instructions from Hamtronics to make the kit construction successful. They went into great detail, giving construction tips and line-up and testing procedures that were easy to follow for the most intimidated kit builder. I am not saying a third-grader could construct these kits, but with limited kit building experience you can feel comfortable putting them together. In retrospect, the only trouble I had in constructing the transmitter portion of the kit was trying to figure out where to use the solid #22 ga. wire. (It was used to hold shield sections in place.) My problem was that I missed the instruction on that item in my quick scan of Hamtronics material. If I had read the material more slowly I would not have missed that instruction.

The remainder of the construction was very straightforward and easy to follow. The only tools needed for the kit's construction were a wire cutter, long-nosed pliers, X-Acto knife, solder and soldering iron. The X-Acto knife was needed to remove the enamel on the wire used for the coil forms prior to soldering. The wire supplied was easy-strip and could be soldered, but I prefer to scrape my coil wire to clean copper. An alternate procedure for fine wire is to have a small capful of rubbing alcohol, dip the wire end into the alcohol and then with a match burn the tip of the wire. After a few seconds quickly dip the hot wire end into the alcohol. The enamel will crack off as the hot wire end is immersed into the cold alcohol. *(Keep the flame away from the alcohol.)* For safety, use only a small capful of alcohol. That is all that is needed anyway. *[Manufacturer's Note: New kits being shipped as of this month have molded coils, so winding on coil forms is no longer necessary. On the few air-wound coils which still require the builder to strip off insulation, be sure to pretin the coil leads after the coils are wound but before they are installed on the board. Thus, the heat is transferred to the wire and not sunk to the foil on the board.]*

All component parts for the kit were packed in a box with the PC board and instructions for that particular kit. All the components needed were sealed in a plastic bag. I suggest you obtain a small tray or box lid to place the components into before you open the bag so you don't drop something and lose it. I used a small photo tray about 4" by 6". Placing all components in the tray allowed the organization of resistors into a low-to-high-value assortment, allowing me to place and select them quickly during the construction of the kit. I used a section of cardboard and inserted the resistors into the corrugated end of the cardboard. If you have any trouble reading the color code you had better use a meter, just to be safe. (I know it, the color code, and assume you do also, but poor eyesight in low-light conditions predicates use of a VOM to confirm just what I think it is. This step avoids problems and is a good confirmation step).

Looking at the schematic and confirming component part locations on the PC board is quite easy after a few components have been placed on the

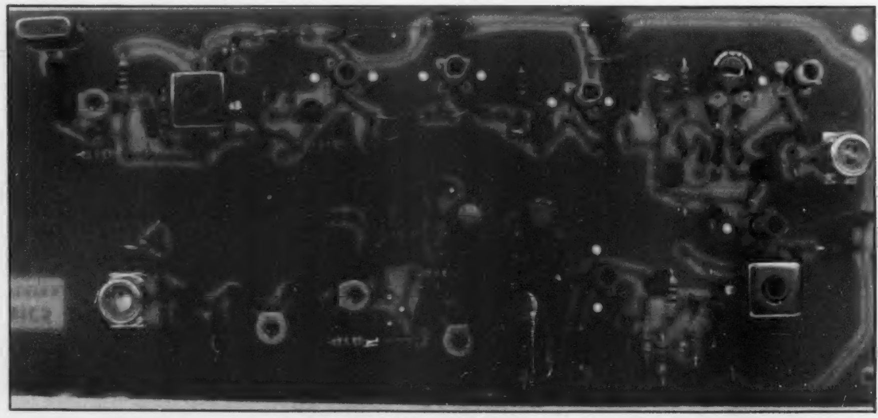

Photo B. Hamtronics transmit converter XV2.

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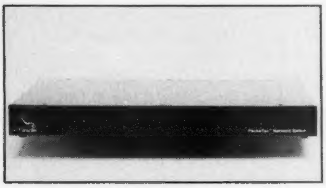

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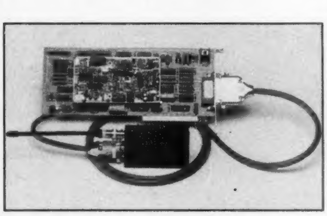

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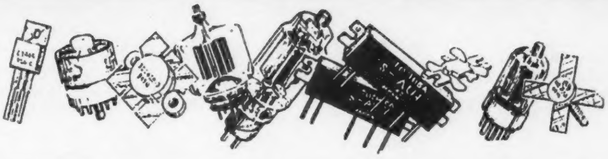

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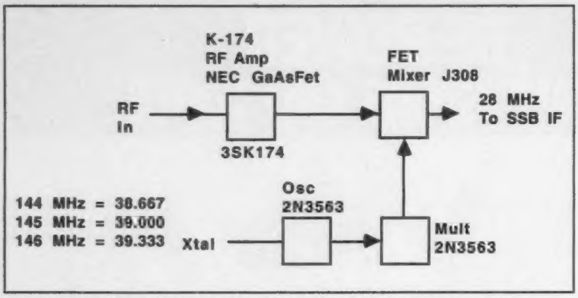
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FET
Mixer J308
RF
In
28 MHz
To SSB IF
3SK174
Osc
2N3563
144 MHz = 38.667
145 MHz = 39.000
146 MHz = 39.333
Xtal
Mult
2N3563

Figure 1. Block diagram Hamtronics CA-144-28 receive converter.

board. A suggestion for construction is to place some of the shields for the coils (without the coils) to give you a starting point until a few parts have been mounted. It helps to visualize the layout of components by separating portions of the circuitry. After a few parts are permanently mounted and soldered, remove them until later when the coils are positioned on the board.

After all the resistors were mounted I sorted the capacitors and used the same procedure as with the resistors. The coils for the receiver were all pre-wound and color-coded for easy installation. In the transmitter kit the 1/8" coil forms needed to be wound with the turns specified. The enameled wire for this was supplied in the kit. The remaining coils are air-wound with the #22 gauge enamel wire on a 1/8" mandrel for a form. Any 1/8" form will do here. The X-Acto knife was used to remove the enamel from the wire to bare the copper to aid in good soldering of connections.

The Hamtronics transmitter kit provides 2 watts of power output in the stock kit as constructed. This is far more power than is needed for up-conversion in a microwave portion of the converter. I have tried several methods of power reduction to limit power to acceptable levels near the +10 dBm range (10 to 25 mW Max. of power at 2 meters). One method is to remove the final transistor and couple through this empty stage. Another method is to remove the +DC voltage to the collector of the final and use the remaining power that couples through the disabled final. In this method the transistor is still connected to the driver and provides a good match to its circuitry. The open collector with the tuned circuit and collector de-coupling still in place will reduce gain to acceptable levels for converter use.

For the Hamtronics converter this proved to be the best method and the simplest to serve the microwave converter with low drive. In any case, you could elect to incorporate a switching circuit in the microwave transceiver to have a 20 or so dB attenuator in the transmit path and switch it out for receive. This would reduce the 2 watts output to converter levels of +10 dBm. Next month I will cover a circuit that has this protection feature using a MMIC amplifier and relay-actuated attenuator. This unit serves as a protection device for the microwave circuitry to prevent accidentally keying a transmitter into a receive microwave mixer. It's a simple protection circuit. In the transmit path lies the attenuator to reduce the full power of the 2 watt power level to about 10 mW out +10 dBm for insertion into the microwave mixer.

There is an SPDT switch in the Atlas R-100 antenna circuit allowing the 28 MHz transceiver to be switched from the receive converter to the transmitter converter. This need not be a coaxial relay—a small open frame or dip-type relay is suitable. The power level, if similar to my conversion, is quite low and any similar type relay will work well. This relay is actuated off the R-100 keying line part of the original circuitry. Select a high resistance relay, like the Radio Shack mini relay part #275-248 ($2.99) or anything similar, for low-current operation. This particular relay has a 320 ohm coil and draws 38 mA when operated from 12 volts. I would prefer a little higher coil resistance but this one will do. See Figure 3 for the system diagram showing the entire inter-connections from the 28 MHz HF SSB driver to both receive and transmit 2 meter converters. As I mentioned, next month I will cover the construction of a simple switching circuit for the 2 meter portion of the circuit.

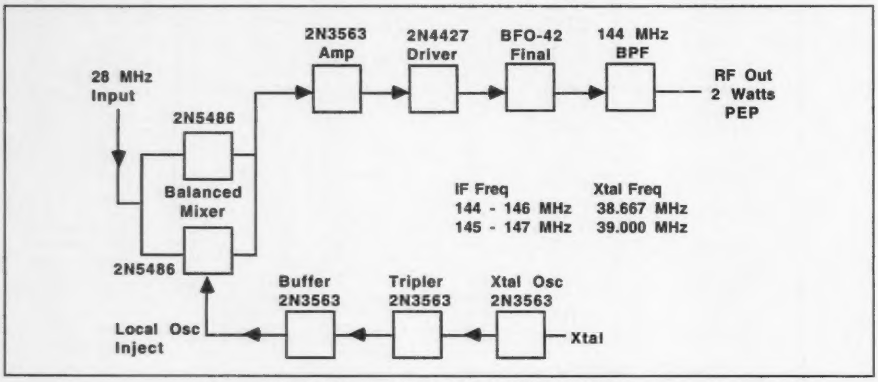
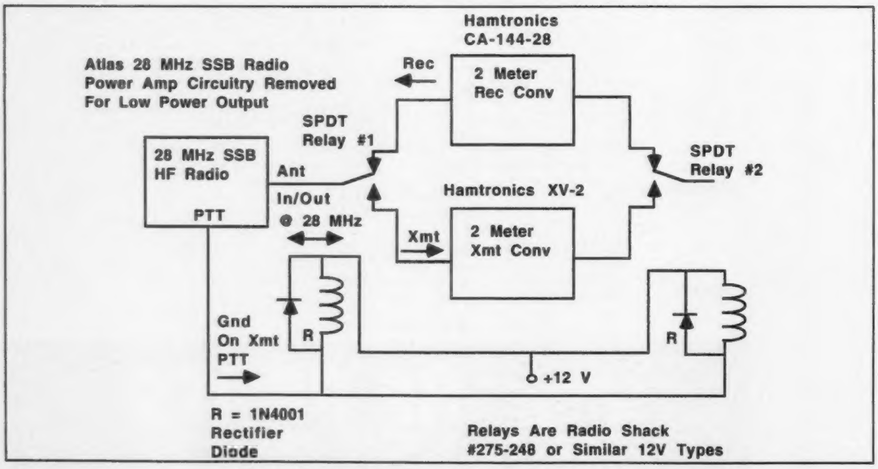

2N3563
Amp
2N4427
Driver
BFO-42
Final
144 MHz
BPF
28 MHz
Input
RF Out
2 Watts
PEP
2N5486
Balanced
Mixer
2N5486
IF Freq
144 - 146 MHz
145 - 147 MHz
Xtal Freq
38.667 MHz
39.000 MHz
Buffer
2N3563
Tripler
2N3563
Xtal Osc
2N3563
Local Osc
Inject
Xtal

Figure 2. Block diagram of the Hamtronics XV2 transmit converter.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PTT
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@ 28 MHz
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SPDT
Relay #2
Xmt
2 Meter
Xmt Conv
Gnd
On Xmt
PTT
R
R
+12 V
R = 1N4001
Rectifier
Diode
Relays Are Radio Shack
#275-248 or Similar 12V Types

Figure 3. System interconnection diagram, HF to 2 meters.

2 Meter Receive Converter

The construction of the 2 meter receive converter is quite straightforward. It was assembled in a similar manner to the transmitting converter; that is: resistors first, capacitors second, coils, then solid-state devices. In this kit all the coils were pre-manufactured on their particular forms and color-coded as to where the coils were to be positioned. This made construction very easy and fast. Again the instruction sheets for assembly were well-documented, with enough information to keep you out of trouble and to answer most questions about construction and testing.

The only difficulty I had was the adjustment of the coils' ferite slugs. The coils in the kit had square adjustment holes and I did not have such a tool in my tuning tool assortment. Hamtronics makes such a tool available but I did not know I needed one for the job. Their tool part number "A28" is 0.060" square. Not having one, I took an old hexagonal tool that was quite worn and fashioned a 0.060"-square shaft on the end of the soft plastic tool. I filed the part square and kept reducing the dimensions until it fit into the slug easily. For easy insertion, I fashioned the tip of this homemade 0.060"-square tool somewhat smaller than required. Be careful as the ferite material is quite brittle and will not take to force of any kind. If your tool can be inserted into the core three-eighths of an inch or more that's fine, as the force will be distributed about the slot and not just at the top. If you just insert the tuning tool into the top portion of the core and try to adjust the core position, the possibility is very high that the core will shatter. You need a tool that will have a good bite and spread the torque about the core slot, instead of just at a part of the core material.

The safest thing to do would be to order the A28 (aluminum and brass) tuning tool when you buy your first Hamtronics kit. This makes sense because otherwise you risk fracturing the slugs, which are made of compressed powdered iron. At the same time, you could order a metal tipped variable capacitor screwdriver tool, if you don't already have one.

The remaining alignment and adjustment of the receiver and transmitter was quite uneventful. I guess the troubleshooting was made easy because of the many components that needed to be placed on the PC boards with care and confirmation, eliminating mistakes. Gremlins can creep in but I am sure you will have as easy a task as I did. With standard construction methods and all the fine material Hamtronics provided with their kit, they made the job easy. See Figure 3 for the interconnections needed to provide the switching necessary for the implantation of single-switch PTT operation on 2 meters with these modules. By the way, you can place the bare bones version of these modules without the microwave equipment attached for 2 meter SSB operation.

Next month I plan to cover the IF switch circuit particulars that will be adaptable to any system for VHF switching. The beauty of this circuit is that it incorporates a protection circuit for the microwave converter that prevents a high level of RF from taking a direct path to the microwave mixer. This can be an embarrassing if not expensive lesson in why we prevent high power from reaching a prized and expensive microwave mixer.

In the switching circuitry for the 28 MHz to 2 meter conversion (Figure 3) use small relays, available from Radio Shack. Remember: For good signal isolation, use two relays to prevent the relays from "talking to each other." The levels used in this switching path are low, as we don't use the full power of the 28 MHz SSB system (limited to about +10 dBm). Additionally, the Hamtronics transmit converter is also limited to low power by disabling the final 2 watt transistor stage to provide again low-level RF for microwave mixing. At this point keep the modifications simple as you might want to return this equipment to normal 2 meter use.

The final Analysis

Was the Hamtronics kit cost effective and did it provide a good base on which to construct a VHF platform for converting HF rig to 2 meters? *You bet!* My only thoughts on improvement would be to have a single PC board with the low-power rec/xmt circuitry for conversion to 2 meters done in such a way that its main use would be for microwavers' applications. Well, there I go again dreaming of the perfect application for my small problem. If we had it our way every time we wouldn't have any fun on the workbench. Besides, the modular design allows the most flexibility, such as for cross band OSCAR operation. I have to thank Hamtronics for providing their modules for our evaluation in this application, and to state that they performed very well. The kits and PC board were easy to follow and in operation performed flawlessly. I highly recommend these Hamtronics kits for your SSB HF conversion consideration.

Mailbox

Greg N8RXB writes: "I am trying to find a simple circuit for use as a 10 GHz detector to show the presence of a signal. A power indicator would be an added plus." Well, Greg, a single diode in a waveguide is the simplest circuit that can be constructed. Obtain a short piece of waveguide for the frequency of interest. In this case a piece of 1" by 1/2" guide about 1" to 2" long will work well. A microwave-type diode is needed and anything similar to a 1N23 will work well. This diode is packaged much like a 22 caliber bullet. The brass bottom case is made for grounding in waveguide and the top is the working contact of the diode. Some diodes are made in such a way that they can be pulled out of the bottom brass case and reversed in polarity. For our application either way will work well—you just have to change the indicator polarity to suit the diode polarity.

I just got a thank you reply back from Greg in the mail and he informs me that my suggestions work very well. He found an old security alarm circuit with a diode attached and reports that the circuit is doing the job nicely.

Dean Lucas N8VMD questions the antenna noise bridge (*73* magazine, February 1994). Dean does not know about the *RSGB Handbook* and is looking for information. Well, Dean, I will send you a copy of the circuit from the *RSGB Handbook.* The book is available from the ARRL library and costs about $30. It is published by the RSGB, i.e. Radio Society of Great Britain, Cranborn Road, Potters Bar, Herfordshire England EN6-3JW. The book is a collection of articles covering almost every aspect of VHF and UHF communications. It is slanted towards material found in the UK but as a sourcebook and idea book it is quite good in describing operations and methods. The author is G. R. Jessop G6JP.

Well, that's it for this month. As always I will be glad to answer questions concerning this and related topics. Please send an SASE for a prompt response. Chuck WB6IGP.

Pad Value (dB)	Shunt R (ohms)	Series R (ohms)	Good for power level:
3	300	18	2 mW
6	160	40	4 mW
10	100	72	10 mW
14	75	120	25 mW
20	61	250	100 mW
30	53	790	1 watt
40	51	2500	10 watt

Table 1. Attenuator values for pad construction, 0 to 40 dB, for use in Figure 3.

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Failure Modes

A long time ago, I wrote a column called "The Way It Goes," in which I described the typical failures found in various kinds of parts, along with the relative frequency of failures, arranged by type of component. Let's take another look at that, this time concentrating on failures in semiconductors, which are by far the most common. Also, let's look at how a failed active component affects the parts around it. Just why do things stop working?

Reliability

If you're old enough to remember tubes, you probably recall pulling the tubes from your malfunctioning TV (or watching your dad do it) and taking them down to the local convenience store. There, you popped them into a socket on a giant tester and checked the tubes' emissions. Usually, one was quite low, and a new $3 tube was purchased. You got home, put them all back in and, wow, the set worked again.

Imagine doing that today! Widespread use of the transistor swept the old tubes and that big tester into oblivion, where they belonged. When solid-state circuits came along, we were promised they would be rugged, reliable and pretty much permanent. Were the manufacturers lying? Kind of. See, the transistor had the *potential* to be all those things, but getting it to actually live up to its promises was, and still is, something else.

> ***". . . CMOS is perhaps one of the most reliable technologies we have and, without it, most of the little, battery-operated toys we enjoy so much, such as pocket TVs and mini CD players, couldn't exist."***

At First

The earliest transistors were made of germanium. This material is a good semiconductor. In fact, it exhibits less voltage drop in the "on" state than does the silicon we use today. Unfortunately, it had other problems, the worst of which was its physically fragile nature. Even a little heat, or a good bump, could fracture a sliver of germanium, causing these parts to be very failure-prone. The average tube could easily outlast the average germanium transistor. Today, germanium is used only in special cases which require the smaller voltage drop. You can still buy germanium diodes, but the transistors are all but gone, thank goodness.

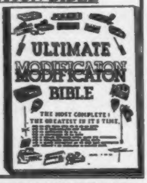
Cool, Man

The tubes wore out because they had to operate at high temperatures in order to work. For a tube, heat is a necessary element. Also, because of the heat and the amount of power being dissipated, other components, such as resistors and capacitors, got fried too. (More on that later.) For a transistor, though, heat is no more than an unfortunate byproduct, because the electronic energy travels through solid matter (hence the "solid-state" moniker), so it doesn't need to be heated up to get it to fly through space. But, transistors do get warm. Sometimes, they get downright hot, especially if they have to handle lots of current. And, as with any material, high temperatures can break down molecular bonds and destroy the device. But what about small-signal parts which don't generate significant heat? Why do they break down?

Zap

One of the biggest causes of component failure is static discharge. A good zap will destroy just about anything, because the rampaging electrons actually burn a hole between layers of the semiconductor, allowing signal electrons to go where they don't belong. And, it's a cascading effect; once the damage starts, the applied power continues it until a total short occurs. And, although you'd think it would be an instantaneous process, as the old song goes, "it ain't necessarily so."

Transistors and ICs designed for very small signals and/or low-power operation tend to have extremely thin boundaries between layers; that's a big part of the reason small voltages can traverse them and operate these devices. It is, however, also a recipe for disaster. Even a small static discharge can punch a nice hole in such thin layers. But, if it's a small hole, the device may continue to work! Over time, though, the hole will get bigger until the device finally fails. It can take months. CMOS chips have built-in protection diodes to help prevent static damage, but it can still happen, especially when the parts are lying around loose. MOSFET transistors, which use essentially the same construction, also are vulnerable. It's not uncommon for a CMOS part which has been damaged by static discharge to work fine for quite awhile and then suddenly short out, so long after the damaging event you can't even remember it happened. I've seen RAM chips do that. Nonetheless, because of its ultra-low-power, cool operation, CMOS is perhaps one of the most reliable technologies we have and, without it, most of the little, battery-operated toys we enjoy so much, such as pocket TVs and mini CD players, couldn't exist.



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Where's the Fun?

The 10 meter test had started, and I expected the band to open about the time I arrived at the motel. Rig and gel cell were in the trunk, Maxi-J was right beside, rolled up inside the launcher pail. Room with a view. Maxi takes off from the balcony sloping down to a tree. His tail slips under the door. And I'm 59 in Japan.

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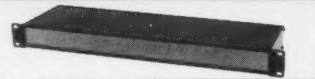

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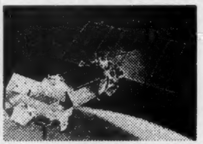

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Made That Way

There's another cause of semiconductor failure, and you can't do anything about it. Like anything else, the structures inside transistors and ICs aren't perfect; they often have extremely small bubbles and holes in them. We're talking sub-microscopic here; it takes a scanning electron microscope to see them. Over a period of months, or even years, electron flow through holes can cause enough damage to begin a short. Also, believe it or not, imperfections can narrow a conductor's effective area enough that it presents enough resistance to generate a small amount of heat. It ain't much but, at this size scale, it doesn't take much! Microscopic aluminum conductor lines can actually melt. Big chip makers employ chemists whose sole job it is to study these molecular phenomena and try to devise ways to prevent their formation. And, as the lines get smaller and smaller, the problem gets worse. If we're ever going to have reliable, affordable multi-megabit RAM chips, this issue will have to be resolved. As it stands now, manufacturing processes are a lot better than they were just a few years ago. That's a big reason why chip densities have risen so much, bringing us 486 micros and such.

The Bumpy Road

Can semiconductors actually break, in the physical sense? As I mentioned before, germanium was prone to doing that. Silicon is a great deal sturdier but, yes, it can happen. I've seen transistors fracture, especially if they were hot when the shock occurred. I've never seen an IC do it, though, but I suppose it could. Crystals, which aren't semiconductors, of course, but are made out of quartz, which is quite fragile when sliced thin, are the worst offenders. If you drop your rig onto a hard surface and any of its crystal oscillators stop working, suspect the crystal right from the start. I can't count the number of bad crystals I've run into, and many of them died from physical shock.

Can't Touch This

You don't need the high voltage of a static discharge to damage a semiconductor. Sometimes, even just a few volts will do, particularly with MOSFETs. And, believe it or not, just touching a lead can occasionally do the dirty deed, thanks to induced voltages and weak, unnoticeable static build-up on your body. That's why people who work with CMOS and MOSFET parts a great deal wear those grounded wrist straps. If you don't have one, it's a good idea to touch something grounded, like your scope ground, after you sit down and before you stick a finger on the circuit board.

The Domino Effect

In the tube days, enough power was being dissipated, and enough heat being generated, to damage resistors, capacitors and coils even when there wasn't anything wrong with the circuit! But with solid-state circuits, that's rarely the case. Sure, there are some power-handling circuits which can heat up and cause those old-fashioned troubles. Power supply regulators and power amplifiers come to mind. But in most circuits, signals are small, and the amount of power being dissipated is so tiny that there just isn't the potential to make much heat.

But, when a semiconductor dies, it often can do some damage to other parts. The usual cause is a shorted transistor or diode's pulling too much current through another component, heating it up to the point of destruction. Typically, the victim is a resistor of low value. Obviously, you can't pull a great deal of current through a 10k ohm resistor running off a 12-volt supply, no matter what you do; even if you put the resistor directly between the two supply rails, you'd only have 1.2 mA flowing, for a total power dissipation of 14.4 milliwatts. Most resistors are rated for at least 250 mW, so there's no problem. But, if the resistor is only, say, 10 ohms, now you're talking trouble, because enough current can flow to heat and crack the resistor. Consequently, emitter resistors in power amps are ripe for damage when the finals short out. Very often, they'll have small cracks which make them open or intermittent. Coils also can be blown that way, because they usually have low DC resistance. But, the heating effects which used to ruin capacitors in the tube days are all but gone; unless a cap is nearly touching a big power transistor, chances are it'll be unaffected by a blowout.

I hope you've enjoyed this little meander through the world of dying semiconductors. As the years go by, the parts get more and more reliable, but they still go and probably always will. Oh well, at least they don't have filaments to burn out. Now, let's look at a letter:

Dear Kaboom,

My Ramsey 2 meter kit radio picks up a lot of intermod. Granted, I live near some big commercial VHF towers, so I can't really fault the rig. Still, I'd love to be able to actually use it! Is there anything I can do to reduce the mess?

Signed,
Barn Door Open

Dear Barn Door,

The Ramsey kit performs about as well as most radios, but the company makes a special filter just for problem areas like yours. Give them a call and they'll tell you all about it.

73 'til next time, de KB1UM.

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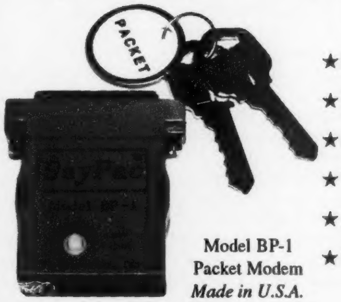

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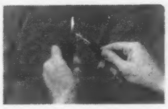

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Notes from FN42

As I am writing this column (March 3), we have just finished receiving six inches of the white fluffy stuff that falls from the sky, and I'm not talking about cottonwood tree cotton, and we are expecting another 2"-3" during the night. This makes storm #15 to come through New England this winter season. We are fast approaching the record for the most snowfall. I really don't care to break the record. I'm running out of space to plow the snow to.

Okinawa's Hambassador David Cowhig is moving to Taiwan in August. I'm sure that Okinawa will miss him, but he has promised to continue his reporting from Taiwan. David also sent some beautiful pictures of the islands around Okinawa and a very pretty QSL. I am submitting the QSL for print because of the very vivid colors of the fish and the blue water. I hope that the QSL will be printed in color. [Ed. Note: Sorry Arnie!] *David also adds that Okinawa has 300 of the known 600 species of coral and some of the finest coral reefs in the world!*

Time for the news of the world—Arnie N1BAC.

Roundup

Ecuador Another "Program Notes" from HCJB, Voice of the Andes, reports that their 1994 QSL series features the people of Ecuador in bright color. Send in a complete reception report to augment your QSL collection.

Also, on Wednesdays, "Ham Radio Today": Get with other amateur radio fans and host John Beck for a half hour of features, tips, news, and helps for your hobby. Airs to the Americas at 0100, 0330 and 0530 UTC; to the South Pacific at 0800 and 1030 UTC, and to Europe at 0800 and 1930 UTC.

Pakistan *Received in the mail from the Pakistan Amateur Radio Society.* Reported in the January 1994 "PARS News Letter" were the following items: From January to December 1993, at least 20 new amateur licenses were issued by the PTC wireless Board Islamabad, great progress for 1993; the PARS QSL Bureau is working very well, having cleared all the incoming and outgoing QSL cards on December 31: Wahid Public School Islamabad is the first school in Pakistan licensed for an amateur radio station, AP5WPS, to promote the amateur radio hobby to the school's senior students; and evening classes for radio hams, Navy and Merchant Ships were started at Wahid Public School on 1 November.

For further information about PARS or to receive the "PARS News Letter," write or call: Pakistan Amateur Radio Society, Zone 21 PO Box 1450, Islamabad, Pakistan 44000 Region 3; Tel. 252858. *[The "News Letter" was six pages long and was very informative, with operating practices and procedures for radio hams, Ham Mailbag, and radio tips.—Arnie]*

Switzerland *From the ITU Press Notes:* Just in case you missed it, the following countries have received membership since January 1: Czech Republic (Jan 1), Georgia (Jan 7), Slovakia (Feb 23), Kazakhstan (Feb 23), Micronesia (Mar 18), The Former Yugoslav Republic of Macedonia (May 4), Turkmenistan (May 7), Eritrea (Aug 6), and Andorra (Nov 12).

The TELECOM 95 FORUM, to be held in Geneva in conjunction with the TELECOM 95 exhibition from 3 to 11 October 1995, has been drastically rethought in light of the changes in the policy, economic, regulatory, financial, development and investments aspects of telecommunications that are now intimately entwined with technology. Innovative in concept, form and substance, the FORUM will consist of two summits, one on strategies and one on technology.

> ***"By establishing a truly open door policy, the FORUM is a unique opportunity to bring all these interest groups together."***

The Forum aims to open up a true dialogue with all relevant companies and organizations affected by the current information technology revolution. "By establishing a truly open door policy, the FORUM is a unique opportunity to bring all these interest groups together," says Pekka Tarjanne, Secretary-General of the ITU, "It will allow the telecommunications industry to explain what it has to offer, and the users' community to articulate its requirements."

The theme of the Technology Summit, "Convergence of technologies, services and applications," will explore in three parallel conference tracks the following issues: communications services for the individual, communications services for business, and national, regional, and global issues.

The Call for Papers for the Summit encourages submissions from all industries involved in or affected by the new telecommunications environment and from governments of all countries, be they developing or developed. The deadline for the receipt of abstracts is August 15, 1994.

For further press information contact Francine Lambert, Chief Press and Public Information; for information on submitting abstracts contact Lili Rison, Project Manager TELECOM 95. Both are at International Telecommunication Union, Place de Nations, CH-1211 Geneve 20, Switzerland.

ISRAEL

Ron Gang 4X1MK
Kibbutz Urim
D. Negev 85530

4X1KT Memorial Packet HF-VHF Gateway Station Up and Working Corrinne Yehudah 4X6VT reports that she has got the 4X1KT memorial packet gateway up and working on the air at Kiryat Yam, a northern suburb of Haifa. Using the late Tzvi Pomer 4X1KT's gear donated by his family, the station is already relaying the traffic between the Haifa 4X4HF BBS and abroad.

When 4X1RU stepped down at the end of December, 4X1KT completely took over the Israeli international forwarding. Corrinne reports that this has been an amazing learning experience, and in one day she managed to pass 1.5 megabytes of traffic with a Greek station. Help has been offered also from Germany and Italy for relaying traffic and bulletins as far as the low sunspots will permit. 4X1GP, 4X1RU, and 4X4XM, to mention a few, have been most helpful getting Corrinne going both with the hardware and software.

Corrinne, who for the past few years has been managing the outgoing IARC QSL bureau, observes that both the bureau and the gateway are like a kitchen sink: No matter how many dishes you wash, there are always more waiting!

The function that 4X1RU served as a BBS for the Tel-Aviv and Central area node (HRZ) has been taken over by the new 4Z4AAA BBS and TLV node run by Yaacov 4Z5AY. There were about three days of silence in the area at the beginning of the year until Yaacov and his crew got everything up and running, otherwise the transition was completely smooth. Now the bulletins from all over the world are daily filling our monitor screens, and we are still blessed with a beautifully functioning packet system.

Many thanks to Jim 4X1RU for all his years of service as BBS SysOp and VHF-HF gateway station. Jim is still active on packet, but now as a private station, and is providing the 4XNet system with fresh AMSAT bulletins, a service much appreciated.

More Pirates Bite the Dust! After we all thought that the Ministry of Communications was impotent and the IARC had won a court precedent that it could have the police arrest pirates and willful interferers and take them to trial, the Ministry's Monitoring Unit has caught a few bootleggers. Although the information that has reached us is sketchy, apparently one of the offenders was in Kibbutz Hamadiya, using the club callsign of a neighboring kibbutz.

Another one was in the Haifa area. A lot of amateur equipment was confiscated. He is now trying, in a crash course, to acquire the required proficiency to pass the next Radio Amateur Examinations, and has offered all the seized equipment as a gift to the IARC!

Another two, reportedly in Herzliya, were using unlicensed amateur gear and were jamming wireless telephones.

4Z85TA Celebrates Tel-Aviv's 85th Birthday From January 1 through April 30, 4Z85TA, a special station commemorating the 85th anniversary of the founding of the city of Tel-Aviv, will be on the air. All modes (and we mean all—CW, SSB, SSTV, packet, AMTOR, PACTOR, and RTTY) will be operated on all the bands, and possibly via satellite as well.

Shlomo Musali 4X6LM, the manager of the station, promises a special QSL for every contact made, and says that a diploma will be available. The conditions necessary for winning the award will be published as soon as known; in the meantime, make it a New Year's Resolution to get on the air and work the station on as many modes and bands as you can!

OKINAWA

David Cowhig 7J6CBQ/WA1LBP
AmCon Naha
FBU PSC 556, Box 840
FPO AP 96372-0840

Summer '93 brought the Taiwan-Japan-Korea-Russia UHF test in late July and portable operations at the many festivals held in Okinawan cities and towns. The Kadena Radio Club operated the UHF test from a hilltop site at Tanodake in northern Okinawa. Taiwanese, Japanese, Korean and Russian stations participate in this annual propagation test. JS6YLV worked a BV Taiwan station on early Saturday afternoon and then turned its beams north to work into Kyushu and Honshu Saturday evening and Sunday. A strong typhoon which hit southern Honshu on Saturday evening reduced activity from that area considerably! The JS6YLV hams proudly told me of how they contacted another island 200 km to the north by ATV (ham television) on 1200 MHz a few years ago from the same hilltop site. The 430-440 MHz ham band is not used for ATV in Japan; 1200 MHz and 2400 MHz are the ATV bands here.

Another group of hams operated from the Onnason Festival. Onnason, a spectacularly beautiful resort, lies halfway up the Pacific coast of Okinawa. Onnason is proud of its early 18th century woman poet Onna Nabe who wrote this verse, the most famous of the Ryukyuan Songs: "I gaze upon the Onna hills/Towards my lover's home village/I want to push the mountains aside/And draw him here to me." Okinawan literature and music, a won-

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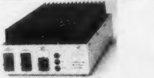
0508R	1	170	28	–/–	Repeater
0510G	10	170	25	15/0.6	Standard
0510R	10	170	25	–/–	Repeater
0550G	5-10	375'	60	15/0.6	HPA
0550RH	5-10	375	60	–/–	Repeater HPA
0552G	25-40	375	55	15/0.6	HPA
0552RH	25-40	375	55	–/–	Repeater HPA
144 MHz					
1403G	1-5	10-50	6	15/0.6	LPA
1406G	25	100	12	15/0.6	Standard
1409G	2	150	25	15/0.6	Standard
1409R	2	150	24	–/–	Repeater
1410G	10	160	25	15/0.6	Standard
1410R	10	160	24	–/–	Repeater
1412G	25-45	160	20	15/0.6	Standard
1412R	25-45	160	19	–/–	Repeater
1450G	5	350	56	15/0.6	HPA
1450RH	5	350	56	–/–	Repeater HPA
1452G	25	350	50	15/0.6	HPA
1452RH	25	350	50	–/–	Repeater HPA
1454G	50-100	350	40	15/0.6	HPA
1454RH	50-100	350	40	–/–	Repeater HPA
220 MHz					
2203G	1-5	10-40	6	14/0.7	LPA
2210G	10	130	20	14/0.7	Standard
2210R	10	130	19	–/–	Repeater
2212G	30	130	16	14/0.7	Standard
2212R	30	130	15	–/–	Repeater
2250G	5	220	40	14/0.7	HPA
2250RH	5	250	40	–/–	Repeater HPA
2252G	25	220	36	14/0.7	HPA
2252RH	25	250	36	–/–	Repeater HPA
2254G	75	220	32	14/07	HPA
2254RH	75	250	32	–/–	Repeater HPA
440 MHz					
4403G	1-5	7-25	4	12/1.1	LPA
4410G	10	100	19	12/1.1	Standard
4410R	10	100	18	–/–	Repeater
4412G	20-30	100	19	12/1.1	Standard
4412R	20-30	100	18	–/–	Repeater
4448G	5	100	22	12/1.1	HPA
4448R	5	100	22	–/–	Repeater HPA
4450G	5-10	175	34	12/1.1	HPA
4450RE	5-10	175	34	–/–	Repeater HPA
4452G	25	175	29	12/1.1	HPA
4452RE	25	175	29	–/–	Repeater HPA
4454G	75	175	25	12/1.1	HPA
4454RE	75	175	25	–/–	Repeater HPA



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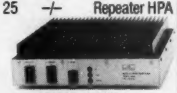

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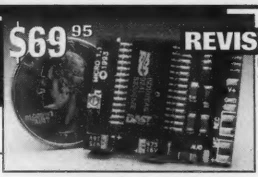

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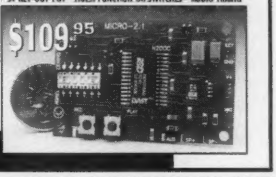

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When we fired it up, the system tuned perfectly on every band. My client is pleased and even asked me to send along her picture, but she had to hide her features because there are still a lot of people in the retirement community who don't realize she's running 9 band DX.

Thank you for your suggestions on this installation.

By the way, I worked Madrid, Spain from the car using the SG 2000, SG-303 and Quick Mount System the other day around 1 PM local time.. Believe it or not, I had a better signal than almost all the fixed stations here in the LA area. Keep it up and best 73's

Jerry Davis, KK6YO"

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derful synthesis of old and new with many elements borrowed from mainland Japan, China and South Asia, reflects the passionate feelings and friendly "i-chari-ba-chode" (to feel like brothers on the first meeting) spirit of the Okinawan people. "I-chari-ba-chode" translates best into English as "Aloha"—Okinawa history and culture have innumerable parallels with the Aloha State. One-fourth of the Japanese-Americans of Hawaii trace their families back to Okinawa.

OKINAWA JAPAN
JS6IIQ
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Photo A. QSL card from JS6IIQ.

In mid-August the first Okinawan Radio Direction Finding Contest was held in the Prefectural Forest near Onnason. The two hams who found the six transmitters in the shortest time won the right to represent Okinawa in the annual Kyushu regional radio direction finding event. Both winners used a 2 meter hand-held yagi/receiver unit manufactured by Mizhuno Radio Co. The 145.18 MHz Foxhunting Friendship Club regularly holds mobile foxhunts one Thursday night a month in southern Okinawa with a nice late-night snack at the site of the fox—the hidden transmitter.

Tourist hams from other parts of Japan listening to the 2 meter band here for the first time are surprised that so many hams here speak Okinawan, a Japanese dialect nearly incomprehensible to Tokyo dwellers. As I write this in January 1994, many of the 1,200 Okinawan hams (6,000 people have ham licenses) are saying "e so- gatchi de-bi-ru" (Happy New Year) to one another in Okinawan as well as the "a-ke-ma-shi-te o-me-de-to go-zai-masu" (Happy New Year in standard Japanese). Okinawa Prefecture (population 1.2 million) has tremendous dialect differences from island to island. Saying thank you, for example, in standard Japanese is "arigato"; for hams speaking dialect on the main island of Okinawa, "ni-hey-day-bee-lu"; on Miyako Island "tandy ga tandy"; and on Yonaguni island, 80 miles off the coast of Taiwan, "fu-ga-la-sa."

To get to the point where they could say "e so-gatch de-bi-ru," Okinawan hams ran a gauntlet of Forget-the-Old-Year Parties (bonen kai) starting in mid-December. After the fine bonenkai of the 145.18 Foxhunting Friendship Group, where we saw a display of foxhunting antennas and enjoyed the fine view from atop the Hotel Ekka in Naha, many of my Okinawan ham friends got ready to go to their second party, to be followed by a third in some cases! In January many people go to New Year's parties as well. Okinawan hams know how to have fun! 73

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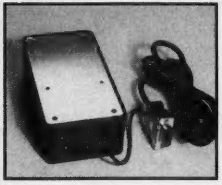

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NEVER SAY DIE

Continued from page 4

there I asked where they were in issuing W4 calls. They checked and said they were just handing out W4NSA at that time. I said to hold W4NSD for me please, which they did. I put in for it while I was there and returned to Southern Pines that night with my first class commercial ticket and my W4NSD license.

I'd brought along my kilowatt NBFM rig, so I had a great time working DX from there. Later I moved to Sarasota, Florida, to work at WSPB, where I was active on 6m and 20m.

In 1951 I moved to Cleveland, Ohio, and applied for W8NSD. I'd put off my application so long that by the time my new call arrived I was fed up with working there and was about to move back to New York. That was the year I operated the first weekend of the ARRL Sweepstakes contest as W2NSD/8 in Cleveland, and the second weekend from New York as W8NSD/2. I had separate rigs, so the only thing in common was my D-104 microphone.

Sometime after that the FCC stopped making such parallel calls available. So when I moved to New Hampshire in 1962 they couldn't give me W1NSD. But they said that they expected to change the rules so I would be able to get the call and to operate as W2NSD/1 in the meanwhile. I had a permanent address in New York at my folks' house, so it was legal. I kept sending in the required notices of portable operation, waiting for the promised rule change. This went on for years. Then, in the '70's they eliminated the portable notification rule. But they never made it possible for me to get W1NSD, so I said to hell with 'em and have been using my W2NSD ever since. I may have set a record for portable operation. It's been 32 years now! Anyone beat that?

So what call would I swap for my old W2NSD/1? Well, I have to admit that I did get a kick out of operating JY1 from King Hussein's palace. So the call of my choice would be "W." Stands for Wayne. Yes, I'll pay. How much do they want? How's that for an ego trip? Would I accept W1? Well, perhaps. So who are they going to sell W to?

Media Inertia

First I want to thank the dozens of readers who wrote in asking for more information on the AIDS cure. I want to particularly thank those who have been putting up with my writing about anything I think will interest you.

The new year was particularly exciting for me because I felt I had some earth-shaking news ahead of the popular media . . . news which would eventually make headlines. The most exciting was the AIDS cure news. Next, by a nose, was the news of what's been developing in the cold fusion field. Imagine, a cure for the world's worst disease and what looks like a new source of unlimited power from nickel and water! Then I got word of a simple and inexpensive new process for converting radioactive waste isotopes into non-radioactive elements and isotopes. Wow! This process seems connected with the cold fusion process.

I wanted to get the word out on these incredible developments as quickly as I could, so I dropped notes to several magazines, asking if they were interested in getting more information. I wrote to *Time, Newsweek, US News, Omni, Discover, Scientific American, Forbes, Fortune,* etc. The only one I've heard from after several weeks was *Omni,* which sent me a form rejection letter.

Oh yes, I also wrote to my senators and congressmen, the governor, Bill and Hillary, Al and Tipper, and a few other elected officials. No word.

Is it that no one of importance reads their mail any more? I read mine, but then I probably don't count as a person of importance, except in my own mind.

Meanwhile, word of the AIDS cure has been appearing in a few medical journals in the US, Canada, and Australia, so that may get around without my help.

The AIDS Circuit

Though the circuit itself is dirt-simple, I wanted to provide as complete instructions to its use as I could so I wrote the whole works up and printed it as an eight-page booklet. I've sent this to everyone who wrote asking me to publish the circuit. No charge. But I have asked for donations to help me get the word out with PR and ads. I've asked that anyone who has AIDS and is cured as a result of my information send me $100 which will be used solely for the promotion of this cure.

If I get enough donations I'll try to find someone to put together easily-built kits of parts to help make this even easier. I've also asked that anyone experimenting with this approach keep careful notes and send me a copy.

Golly, it was back in 1964 that I got involved with putting together parts kits. I wanted to help the *73* readers be able to build the construction projects we published. I tried first to interest an outside company in doing it, but couldn't find anyone interested. So I hired a ham from Milford, the next town east of here, to handle the kits. It meant building a test unit, writing up the detailed instructions, buying the parts, listing the kits in the magazine, then packing and shipping the kits

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when they were ordered. Sounds simple, eh? What a hassle!

When he got hopelessly screwed up with this I moved him on to something else and tried a ham from Keene, the next big town to the west. The kits were late, ads wrong, parts not ordered, and so on. I finally gave up and did it myself. I bought all my parts from Evans Radio In Concord, NH, wrote the instructions, picked the parts, wrote the labels, and had a good business going.

But I was also busy publishing not just *73*, but also *6 Up*, *5-7-9*, *ATV*, and a club newsletter editor newsletter. *6 Up* was a VHF-UHF newsletter. *5-7-9* was for contesters. These four newsletters were written by experts in the fields, edited by the *73* crew, and I printed 'em all on an AB Dick 360 press in my garage. I had local high school students come in after school to do the collating, stapling, and addressing.

This was all working fine except for a couple of teeny weeny little problems. First, and least significant, was that I was paying the kids 50¢ an hour to work. They loved it, but that was less than the minimum wage, so I had to fire them and put in a collating machine and an automatic addressing machine. That saved me money, but put the kids out of work. They used their new spare time to get into trouble.

The second teeny problem was my divorce from my first wife, which really threw me for a loss. I got so sick over it that I couldn't work more than a few minutes a day without collapsing. So I had to stop publishing the four newsletters. I ended the parts kit program. I turned the Institute of Amateur Radio over to one of the directors to run, and hired a manager for *73*. The Institute director quickly bled the membership bank account dry. My manager/editor did an outstanding job of trying to put *73* out of business. He stopped sending out renewal notices. He canceled several thousand subscriptions. Then he walked out and left me with not only that mess, but with not one single article for the next issue. He took along my circulation manager, and my entire production department. He tried to hire away my assistant editor and bookkeeper, and so on. He used all the articles to help start *Ham Radio*, a move which tended to put a strain on our relationship from then on.

It's been a long time since I've written about the early days of *73* . . . I'll have to tell you some of the stories about those times.

So now I'm considering getting back into handling kits again. Well, a kit, anyway. But if it'll help save a few thousand lives, I'll be glad to help. Maybe I'll be able to find someone this time who'll be able to run a small kit business for me. Oddly enough, when I first heard about the AIDS cure we tried to get two ham kit companies to do this one . . . and they wouldn't.

DRA

This is my latest attempt to try and get some intelligence into ham QSOs. I suppose I should just shut up about this and stop grumbling. Hams, trapped by an age-old technology where they can only talk or listen, but not both, will probably never be able to maintain many interesting conversations. Oh, I've come up with some fairly simple ways to get duplex contacts going, but to no avail.

Back when I was in the fifth grade at the Oyster School in Washington, DC, they had a clever way of getting all the students to read the paper every day. That's more than most kids do now, right? They had a dummy microphone in the class and each student had to get up and give a news item from yesterday's paper. We had to be prepared with several items because no duplication was permitted. That had us reading the papers, looking for unusual and interesting items.

The DRA stands for "didya read about." The idea is to clip interesting items from newspapers and magazines and have 'em handy near the rig so you can pick one up and ask DRA.

I don't know about you, but I read a ton of magazines (but no newspapers) and I'm a clipping fiend. Call me the Yankee Clipper. I pull the pages out of magazines on politics, health, EMF, and so on. Just under C I have clipping files for capitalism, child care, classical music, Clinton's plans, clothes, cold fusion, colleges, computers, Congress, copy writing, cosmology, crime, and cutting government.

If you've worked me recently on the air the chances are that I somehow managed to steer the conversation around to AIDS or cold fusion. But if you have anything that interests you, the chances are good that I'll be interested too. I just want to talk about something other than what rig or antenna you have. I like to use our communications medium for communicating. I want to know what work you do, what other hobbies and interests you have, and anything new that I might have missed.

Many readers delight me by finding articles in their local papers they think will interest me and sending me clippings. I really enjoy that. So keep a pair of scissors handy and clip for your file. And if you find something you know I'm interested in, send me a copy. OK?

Loony Tunes . . .

That's the answer some scientists have used to ridicule others for continuing to research the cold fusion phenomenon. Many areas of research are

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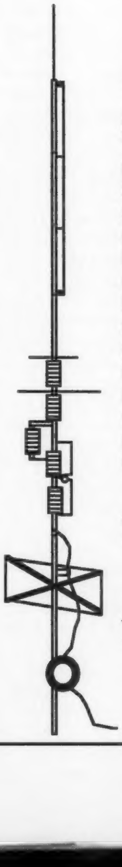

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cut off from any significant funding by the Loony-Tune derision. Of course there's nothing new about this, as I've explained before. The Wright Brothers were ridiculed as frauds for several years after their maiden flight. It was so bad that they left America and went to France, where their work was appreciated. The same thing Pons and Fleischmann did.

There are so many areas that scientists should be researching, but are prevented by ridicule, that if we are ever able to overcome that reaction by the pathologically skeptical, we'll be able to enjoy more progress in understanding the world and life than anything we've seen in the past.

There are so many "crazy" things that science has ignored that I can only list some of the major ones that come to mind. I've read enough books to convince me that we need to find out a lot more about death, reincarnation, the spirit world, psychics, psychic healing, clairvoyance, fortune telling, psycometry, predicting the future, UFOs, UFO contactees, auras, spoon bending, prayer, communications between and with plants, dental amalgam, vitamins, light, bioelectromagnetism, electromagnetic fields and health, mob psychology, magnetism, communications with extraterrestrials, near-death experiences, out of body experiences, mind reading, limb regeneration, light and health, all that missing dark matter, serendipity, coincidences, past lives, acupuncture, herbal medicine, homeopathy, chiropractic, the placebo effect, music and health, fire walking, speed healing, psychokinesis, long delayed radio echoes, and so on. How do Ouija boards work? How about automatic writing? How can yogis control their heart rate, body temperature, blood flow, and so on? Is dowsing all baloney?

As I've mentioned, you can become a research scientist in your own home with nothing more than a bunch of beans and some pots to grow them in. You can experiment with the effects on their growth of being exposed to either the north or south pole of a magnet, exposed to different colors of light, to AC fields, to radio fields, and even to prayer. Yes, I know it looks stupid to pray to a bean, but wait'll you see what it can do! Try some beans up near your linear, with some at a distance as a control. And some near your TV set.

By the time we've opened up most of the fields I've mentioned we're going to know a lot more about our world, about life, and even maybe begin to understand a lot more about God.

One nice thing about quantum mechanics was that it knocked the stuffing out of the old-guard scientists. Most reacted by refusing to accept it. I've told you Max Planck's response to that. And sure enough, the old-timers gradually died off, taking their refusal to believe in quantum theory to their graves. Well, we have our own version of that with our believers in CW. Oh, CW is fine, it just shouldn't be a religious matter. And it also shouldn't be used to make amateur radio a skill hobby instead of a technical hobby. CW requires no mind at all. It's a subconsciously developed skill. I prefer to have amateur radio depend on expanding the mind, not killing it.

Perhaps, without our need for ever more complex and expensive military weapons, we'll be able to devote more money to non-military research and development. The latest figures I've seen have put the American overall scientific budget at about 80% military-oriented. That stinks. How much more technology do we need to butt into countries where we have no strategic interests? There are dozens of countries all around the world where our media will be pushing us to send in our military for humanitarian reasons. Well, atrocities sell papers and build TV ratings, plus they give Congress an excuse to keep up their military pork spending. Let me know when you think you are getting tired of being manipulated by the media.

One of the results of the ridicule in America of cold fusion researchers is that most of the exciting developments in the field are happening in other countries. We're getting left further and further behind. The latest report is from an Italian group who've got a system working that they can turn on and off at will, and which, once started, generates around 300 kilowatts using only three grams of nickel and some hydrogen for fuel. They haven't gone public with this yet, so we'll see if it's real when they've finished their patent applications.

The time was when hams led the communications industry in the development of new technologies. We pioneered FM. We pioneered NBFM, SSB, SSTV, and repeaters. We even pioneered TV. Some of the early commercial TV people had cut their teeth in an amateur TV studio in Long Island City. When I worked as an engineer and then as chief cameraman at WPIX (channel 11) in New York back in 1948 several of the people working with me were alumni of the Long Island studio.

There are many areas wide open for hams to research and pioneer, once we stop being scared off by the commercial research scientists. We have an enormous advantage over them in that they know that when they tackle a project they'd better damned well come up with a positive result. It's a vicious world out there for scientists. Amateurs are gambling their own time and money. This is why most of the major new breakthroughs in technology have been made by amateurs. When we win we're heroes. When we miss, we're the only ones who need know about it. And we're not under any publish-or-perish threat.

I'm Proud to be an American!

Just look at everything we have to be proud of. We all know that America is the greatest country in the world. Love it or leave it, right? Well, we all love America. And we are justly proud of a country which used to be the car capital of the world. Which used to be by far number one in electronics and high-tech.

Well, we're still number one in a great many ways and we shouldn't forget it! We have one of the most corrupt governments in the world. We have one of the most expensive and least effective school systems in the world. We have one of the most expensive health care systems in the world. We have some of the most corrupt unions in the world. We have the worst crime problem of any country in the world. We have more murders per capita than any other country. We have more racial strife and bigotry. We have one of the worst drug problems in the world. We have more lawyers and lawsuits per capita than any other country. We have the highest federal deficit in the world. We have the worst trade deficit in the world. We have the most dangerous cities in the world. We have the best music in the world, but of course, 83% of our music comes from foreign-owned companies (mostly Japanese). We have more people in prison per capita than any other country. We have the wealthiest organized criminal groups in the world. We have more employees in government than in manufacturing. And we're world-class when it comes to encouraging entrepreneurs . . . to tap our government via HUD, food stamps, and endless health care scams, all dutifully reported on our exposé TV shows.

We can well be proud of our street gangs, our riots, our welfare system, our decaying cities caused by rent control, our polluted rivers, our radioactive and industrial waste record, black family disintegration, smog and air pollution, the IRS, Bill and Hillary, our obscene music lyrics, guns in schools, vapid sitcoms, illegal immigrants, our foreign aid program, our lobbyists in Washington and all state capitols, our porno industry, our military procurement system, our banking mess, our savings and loan mess, our tobacco farmer subsidies, corruption on Wall Street, NASA's monumental inefficiency, our eager acceptance of eco-scams . . . you continue the list please.

> ***"And most of all, I'm truly proud of my fellow Americans, who are able to stomach all this corruption and waste without a whimper."***

Rome had its circuses, with Christians fighting lions and each other. We have TV so we can gawk at mayhem in Bosnia and Somalia, so we can spend our days enjoying important things like a severed penis, an attacked skater, our Bureau of Firearms wiping out a dangerous colony of religious nuts, and more religious nuts fighting or defending abortion. We relish every murder in the news, and then turn to crime shows for more. We shine our media spotlight on any protest group. We fan the flames of sensitivity. We're sensitive to women, to homosexuals, to the "disadvantaged," to blacks, to the poor, to the short, the fat (so don't eat so damned much, fatty), the homeless, the lunatics, and so on.

I'm proud of our choice of presidents. Of Lyndon Johnson who so enthusiastically pursued the expensive and lost war in Vietnam and launched the long, expensive and lost war on poverty. Of Nixon, who still insists he was not a crook. Of Ford, who gave us lots of laughs. Of Carter, who gave us hyper-inflation. Of Reagan, who gave us the movie star president we'd always dreamed of. Of Bush who gave us . . . gave us? Oh yes, of Bush, who finally fed us up with both the Democratic and Republican parties, forcing us to lean on Ross Perot . . . who then crumbled under the weight.

And most of all, I'm truly proud of my fellow Americans, who are able to stomach all this corruption and waste without a whimper. I'm proud of how our factory production school system has changed what was once a fiercely proud nation into a nation of wimps. I'm enjoying the spectacle of a people trying to enact a constitutional change to limit terms . . . please stop me from endlessly re-electing my crook. And another to balance the budget . . . please stop me from letting my representatives spend my children's money. I'm proud of our stomach for congressional pork.

What other country would allow pedophile (man-boy love) groups to parade? Would provide police protection for hate groups to parade? Would listen by the millions for hours a day to Rush Limbaugh, Howard Stern, and G. Gordon Liddy? What other country would watch Donahue, Oprah, and Geraldo on TV every day exploiting sickos?

I hope you are as proud to be an American as I. I'm proud of the National Rifle Association and the American Association of Retired Persons for their effective lobbying, no matter what it is doing to our quality of life. Do you know that we have the most corrupt newsstand circulation system in the world? And the most corrupt music industry too? When it comes to superlatives, we've got most of 'em cornered.

Now, if you happen to be a troublemaker and less of a Pollyanna than I, you might look at the downside of some of the superlatives I've listed.

Yes, the Mafia is ruthless and into hundreds of businesses, but by golly, it works! It works fabulously. The average Mafioso makes well over a million a year, and what spells success more in America than making big money?

When we heard that Perot was a multi-billionaire we wanted him for president, and never mind some screws that seemed to be loose. Maybe we'll run Bill Gates next time. Bill, who I happen to know personally, also has some screws loose, but the recent media campaign to make him a household word should should successfully hide those blemishes.

But even if someone were to actually get upset over the negative aspects of the things I've mentioned, we're all on this big train going a hundred miles an hour toward hell and there's nothing any of us can do to change things. Right?

Wrong, actually. I've got a challenge for you. Let's see how creative you are. What is one thing that you could do which could change almost everything many probably clinically depressed people see as negatives? Let me make that even more of a challenge. What is one thing you could do which would take an average of about 12-seconds a day and which would inevitably change the welfare system, the social security mess, the deficit, crime, crowded prisons, the drug war, foreign aid waste, unemployment, housing values, lower taxes, and so on?

Now, if you look back over the list, you'll see that virtually every outstanding misery in our country comes down to being caused or encouraged by the government. The government *you* elected and are paying for.

Is the situation hopeless? Yes, unless *you* change. Look, your politicians aren't going to change by themselves. It isn't going to be easy to change them . . . but it actually can be done. Here's a scenario for you to think about. Let's suppose that no matter how good an elected politician seems to be doing his job, that without fail he is replaced in the next election by someone new. This would kill the congressional seniority committee system, which lies at the heart of most of our problems. Many congressional freshmen come in hoping to make changes. It doesn't take them long to learn that they either play ball or they'll get zip. No committee appointments worth spit No pork. Nil.

Never, ever, re-elect any politician. If we keep flushing the toilet long enough we'll finally begin to see clean water in the bowl. One term. Period. Next! I'd love to see NMI bumper stickers all over the country. No More Incumbents. Is this something your radio club could do?

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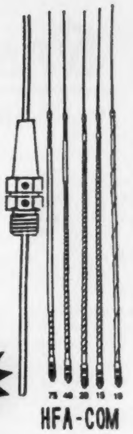

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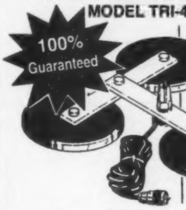

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SPECIAL EVENTS

Ham Doings Around the World

Listings are free of charge as space permits. Please send us your Special Event two months in advance of the issue you want it to appear in. For example, if you want it to appear in the January issue, we should receive it by October 31. Provide a clear, concise summary of the essential details about your Special Event. Check ***Special Events File Area #11*** *on our* ***BBS (603-924-9343).*** *for listings that were too late to get into publication.*

MAY 1

BEMIDJI, MN The Paul Bunyan ARC of Bemidji will hold its annual Hamfest from 8 AM-2 PM. Flea Market. VE Exams. Dealers. Talk-in on 146.13/.73. Contact *Steve Hake, Hamfest Chairman, 4331 Pincherry Rd., Bemidji MN 56601. Tel. (218) 751-9558.*

BURLINGTON, IA Valley Emergency Comm. Assn. will host Burlington Hamfest '94 from 7:30 AM-3 PM, at the Burlington Drive-In Theater on Agency St. Talk-in on 146.790/.190 W0LAC/R and 146.520 simplex. Contact *Chuck Gysi N2DUP, Burlington Hamfest '94, P.O. Box 911, Burlington IA 52601-0911*, or call *(319) 752-3000 (voice/fax).*

HERKIMER, NY The Fort Herkimer ARC will hold a party at the Herkimer County Home for the Aged, from 1 PM-3 PM, to celebrate "Dean Wallace Day," in of honor Dean K2ANM, Oldest Active Amateur Radio Operator in Herkimer County. Dean, who was born in July of 1899, was first licensed in 1919!

YONKERS, NY The Metro 70cm. Network will present a Giant Electronic Flea Market at Lincoln H.S., 9 AM-3 PM, rain or shine. VE Exams. Talk-in on 440.425 MHz PL 156.7; 223.760 MHz PL 67.0; 146.910 Hz; and 443.350 MHz PL 156.7. Mail reservation payments to *METRO 70 CM NETWORK, 53 Hayward St., Yonkers NY 10704.* For details, call *Otto Supliski WB2SLQ, (914) 969-1053.*

MAY 7

EAST LIVERPOOL, OH A Hamfest will be held by the Triangle ARC from 8 AM-3 PM at Calcutta Fire Hall. Talk-in on 146.70. Contact *Dick Sisley K8JKB, 1218 Northside Ave., East Liverpool OH 43920.*

GRASONVILLE, MD Kent Island ARC will hold their Hamfest at Grasonville VFW, from 0800Z-1400Z. Talk-in on 146.94 Rptr. Contacts: *Tom Dove K3ORC, (410) 643-4675; Glenn Durbin WN3G, (410) 643-1125; Jim Smith K3UBC, (410) 643-3338; Jerry Miante K1JUM, (410) 643-2782.*

MANITOWOC, WI The Mancorad RC will hold its annual Hamfest, starting at 8 AM, at the Manitowoc County Expo Ctr. Amateur/Computer/Electronics Flea Market. VE Exams. Mail checks w/SASE to *Mancorad RC, P.O. Box 204, Manitowoc WI 54221-0204*; or call *Red, (414) 684-9097 days; Ron (414) 793-4733 eves.*

OWEGO, NY A Hamfest sponsored by Southern Tier ARC will be held at Marvin Park Fairgrounds from 8 AM-4 PM. VE Exams. ARRL Forum. 35th Annual Banquet. Flea Market. More. Talk-in on 146.16/.76 or 146.52/.52. Contact *STARC, P.O. Box 7082, Endicott NY 13761-7082.*

SIERRA VISTA, AZ The Cochise ARA will have their annual Hamfest from 7 AM-4 PM. For VE Exam info, call *Frank Ivey, (602) 378-9404.* For Hamfest info, contact *Tim Mize, (602) 458-5257.* Talk-in on 146.76/.16.

MAY 8

ATHENS, OH The Athens County ARS will hold its 15th annual Hamfest and Flea Market from 8 AM-3 PM at the City Rec. Center. Indoor space is available only by advance registration; Contact *John Biddle WD8JLM, 80 Wonder Hills Dr., Athens OH 45701. Tel. (614) 594-8901 after 6 PM.* For info, write to *Carl J. Denbow KA8JXG, 63 Morris Ave., Athens OH 45701-1939.* Talk-in on the Club repeater at 145.15 MHz (-600).

MEDINA, OH The Medina 2 Meter Group, Inc., will hold their Ham/Computer/Electronic Hamfest at Medina County Community Center, 735 Lafayette Rd. Flea Market Set-up at 6 AM. For details, contact *Medina Hamfest Committee, P.O. Box 452, Medina OH 44258. Tel. (216) 725-4492, 10 AM-5 PM.*

MAY 14

CADILLAC, MI The annual Swap and Eyeball QSO will be held by the Wexaukee ARC at the Cadillac Middle School. Talk-in on 146.98 Rptr. Contact *Wexaukee ARC, P.O. Box 163, Cadillac MI 49601*; or call *Dan KE8KU, (616) 775-0998.*

ETOBICOKE, TORONTO, CANADA The Skywide ARC will host their annual Spring Hamfest and Flea Market from 8:30 AM-1:30 PM, (Set-up at 7:30 AM) at the Westway United Church, 8 Templar Dr. Talk-in on 146.985/R or direct 146.52. Reserve early for best tables. Contact *John Wilson VE3WIL, (416) 663-0178*; or *Rex Sweetapple VE3XER, (416) 663-0288.*

MAY 14-15

FT. WAYNE, IN The Ft. Wayne Computer Fair, sponsored by Trade Show Productions, Inc., will be held from 10 AM-5 PM at the Memorial Coliseum. Flea Market. Demonstrations. To reserve space, make checks payable to *Trade Show Productions, Inc.*, and return to: *Mark Hanslip, 143 Schloss Ln., Dayton OH 45418.*

SELAH, WA The Yakima ARC will hold their annual Hamfest at Selah Middle School. Seminars. VE Exams. Breakfast, lunch, and banquet. Talk-in on 146.660. Contact *Dick Umberger N7HHU, (509) 248-3580.*

MAY 15

CAMBRIDGE, MA The MIT Electronics Research Soc., the MIT Radio Soc., and the Harvard Wireless Club will hold a Tailgate Electronics/Computer/Amateur Radio Flea Market from 9 AM-2 PM at the corner of Albany and Main. For reservations and info, call *(617) 253-3776.* Mail advance reservations before May 5th to *W1GSL, P.O. Box 82 MIT BR., Cambridge MA 02139.* Talk-in on 146.52 and 449.725/444.725 - pl 2A - W1XM/R.

HOLLY, MI The 4th annual ARRL sanctioned Hamfest/Computerfest, sponsored by the Fenton Area ARA and the Ben Sherman Middle School ARC, will be held

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at Ben Sherman Middle School. Hamfest 8 AM-2 PM (Set-up 6 AM-8 AM). Talk-in on 146.780 (-600) and 442.250 (+5 MHz) linked Rptrs. Contact *FAARA, P.O. Box 46, Fenton MI 48430.*

WAUSEON, OH The North-West Ohio Tri-County HAMFEST will be held at the Fulton Co. Fairgrounds on State RTE 108 (Ohio Turnpike Exit 3). Flea Market. VE Exams by appointment only; Contact *Tom Hay, (419) 542-6192*, before May 8th. Talk-in on 147.195+ K8BXQ Rptr. Phone *(419) 264-7775* for table reservations or info; SASE to *Mike Sharpe N8RLD, 126 Muntz St., Holgate OH 43527.*

WHEELING, WV Triple States RAC, Inc. will present their 17th annual Wheeling Hamfest-Computer Show at Wheeling Park, from 8 AM-3 PM. Antique Car Display. 1912 Beechy Plane replica on display. Talk-in on 146.91. Contact *TSRAC, Box 240, RR 1, Adena OH 43901. Tel/Fax (614) 546-3930.*

MAY 20-22

ROCHESTER, NY The 60th annual Rochester Hamfest and Computer Show, combined with the Atlantic Div./New York State ARRL Convention, will be held at Monroe County Fairgrounds, Route 15A & Calkins Rd. Sponsored by the Rochester ARA. The Flea Market will run continuously for the entire weekend, starting at noon, Fri. May 20th. For info, call *(716) 424-7184 during weekday business hours.* For a brochure, write to *Rochester Hamfest, 300 White Spruce Blvd., Rochester NY 14623.*

MAY 21

COLORADO SPRINGS The Pikes Peak RAA will hold a Ham Radio Swapfest from 8 AM-3 PM at Liberty H.S., 8720 Scarborough Dr. Ham gear. Computers. Electronics. Talk-in on 146.97/.52. Swapfest Contact: *Harv Hunter WA3EIB, (719) 597-8964.* VE Exams begin at 9 AM; contact *Rick Brown KD0SU, (719) 531-9423.* Send pre-registration checks payable to *PPRAA*, with SASE to *John Kramer N0VBM, 1765 Kimberly Place, Colorado Springs CO 80915. Tel. (719) 550-1489 after 5 PM.*

EPHRATA, PA The 9th annual Ephrata Hamfest-Flea Market will be held by the Ephrata Area Repeater Soc., Inc. at the Ephrata H.S., 803 Oak Blvd. Their Radio/Computer/Electronic Flea Market will start at 8 AM (Set-up at 6:30 AM). VE Exams will begin at 9 AM. Make checks for $5.75 payable to "ARRL/VEC." Bring original and a photocpy of your current license, and 2 forms of ID. Flea Market Pre-registrations deadline is May 10th. No refunds. Make checks or money orders payable to *Ephrata Area Repeater Soc., Inc., 906 Clearview Ave., Ephrata PA 17522. Tel. (717) 336-2514 (after 6 PM).*

FORESTDALE, RI The Rhode Island Amateur FM Rptr. Service, Inc., will hold their annual Spring Auction and Flea Market at VFW Post 6342, Main St., Forestdale (No. Smithfield). The Flea Market opens at 8 AM, with the Auction beginning at 11 AM and continuing until about 3 PM. Talk-in on 146.76. Contact *Rick Fairweather K1KYI, 106 Chaplin St., Pawtucket RI 02861*; or call *(401) 725-7507 between 7 and 8 PM.*

MINNEAPOLIS/ST. PAUL, MN A Tailgate Swapfest will be held by the TwinsLAN ARC, at Honeywell Ridgway facility parking lot, 2600 Ridgway Pkwy. Open to the public 7 AM-1 PM (Set-up at 6:30 AM). Talk-in on 146.76/.16 K0HB Rptr. Contact *Bill Brisley N0BSN, 18025 Cynthia Dr., Minnetonka MN 55345-4206. Tel. (612) 474-0118.*

PADUCAH, KY The Paducah ARA will sponsor an ARRL Hamfest from 8 AM-2 PM (Set-up at 6:30 AM), at Noble Park Civic Center. Flea Market. VE Exams. Concessions. Other goodies available. Contacts: *David Fraser KQ4IU, 5715 Blandville Rd., Paducah KY 42001, (502) 554-7999*, or *Paul Smith N4FFO, 229 Nickello Hts., Paducah KY 42001, (502) 898-6834; packet address @W4NJA.WKY.KY.USA.NA.*

PHILLIPSBURG, NJ The Cherryville Hamfest, sponsored by the Cherryville Rptr. Assn. II Inc., will be held from 8 AM-2 PM at the Warren County Farmers Fairgrounds. Set-up at 6 AM. Flea Market Contact: *Keith Burt KF5FK, (908) 788-4080.* VE Exams Contact: *Marty Grozinski NS2K, (908) 806-6944.* Talk-in on 147.375+ and 146.820-.

SACRAMENTO, CA Visit the Carmichael Elks Lodge in Carmichael, between 8 AM-3 PM, to enjoy the annual Hamswap sponsored by the North Hills Radio Club. Talk-in on 145.190- (K6IS). For details, write to *NHRC, P.O. Box 41653, Sacramento CA 95814-0635.*

MAY 22

CANFIELD, OH The Canfield OH Fairgrounds on RT 46 will be the location for the 10th annual Hamfest/Computer Show sponsored by the Twenty Over Nine Radio Club. Doors open 8 AM-3 PM, (Set-up starts at 6:30 AM). For info, contact *Don Stoddard N8LNE, 42 S. Whitney Ave., Youngstown OH 44509, (216) 793-7072*; or *Dave Mellott KE8KT, 2895 Penny Ln., Austintown OH 44515, (216) 793-0816.* Advance registrations must be received by May 15th; send with SASE to *20/9 ARC Inc., 42 S. Whitney Ave., Youngstown OH 44509.* Talk-in (before 1 PM) on 147.315+, 443.225+, or 224.160 MHz simplex.

PLAINEDGE, NY The Suffolk County RC and the Great South Bay RC will hold their Long Island Hamfest/Computer Show from 9 AM-4 PM at the Plainedge H.S., Wyngate Dr. Talk-in on 146.685 and 223.86. Contact *Andy Feldman WB2FXN, (516) 928-3868 (eves. 7-10 PM);* or *Walt Wenzel KA2RGI, (516) 957-5726.*

MAY 28

COLUMBIA, MO The Central Missouri Radio Assn. will hold their 19th annual Hamfest/Computer Expo from 8 AM-4 PM at the Hearns Multi-Purpose Bldg. on Stadium Blvd. Contact *W. "Mac" McKenzie, Jr. K4CHS, (314) 882-7413 days; (314) 442-7619 eves.*

SPRINGHILL, LA The Springhill and Ark-La ARCs will co-host the North Louisiana/South Arkansas Hamfest at Springhill Civic Center. Flea Market. Forums. Commercial Dealers. Contact *David Smith KF5BF, P.O. Box 812, Springhill LA 71075. Tel. (318) 539-3226.* Talk-in on 146.73 and 147.39.

MAY 29

SOREL, QUEBEC, CANADA The Club Radio-Amateur Sorel-Tracy will hold their "Hamfest du Quebec" at The Curling Club. For details, write to *Club Radio-Amateur Sorel-Tracy, C.P. 533, Sorel, Quebec, Canada J3P 5N6.*

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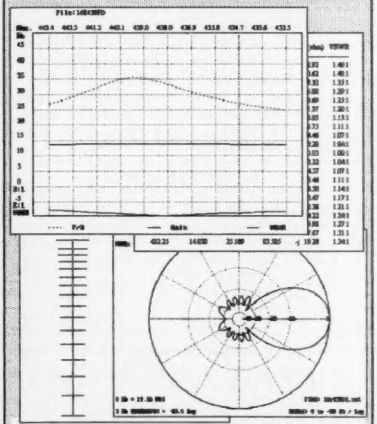

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MAY 30

SYLACAUGA, AL The 3rd annual Talladega RAC Hamfest will be held at J. Craig Smith Comm. Center beginning at 8 AM. VE Exams at 8 AM sharp, with walk-ins accepted. Forums. Contact *Jim KD4BHH, (205) 245-7825.*

JUNE 4

KITCHENER, ONT., CANADA The 20th Central Ontario Amateur Radio Fleamarket will be held at Bingeman Park. Contact *Jack Knight VE3RGY, 35 Brockville Ave., Guelph, Ont. Canada N1E 5X5. Tel. (519) 823-1358.*

KNOXVILLE, TN A Hamfest will be held from 8 AM-4 PM at Tennessee Valley Fair Grounds-Chilhowee Pk. Sponsor: RAC of Knoxville. VE Exams. Talk-in on 147.30+ RACK Rptr., and 224.50+. Dealers contact *Angela Crigger N4RPR, 2707 Pine Hill Dr., Knoxville TN 37938. Tel. (615) 694-9071.* For info, contact *Ross A. Ramsey KC4YDR, 790 N. Cedar Bluff Rd., Knoxville TN 37923. Tel. (615) 690-1520.*

TEANECK, NJ The Bergen ARA will hold its annual Spring Hamfest from 8 AM-2 PM at Fairleigh Dickinson Univ. in Teaneck. Pre-registration required for Flea Market spaces w/power; Contact *Jim Joyce K2ZO, (201) 664-6725.* VE Exams; contact *BARA VE Hotline, (201) 797-0151 before 10 PM.* Talk-in on 146.190/.790; 145.620 simplex.

JUNE 5

EVANSVILLE, IN The Tri-State ARS will hold their 47th Hamfest/Electronic/Computer Show at the Vanderburgh County 4H Center, Boonville-New Harmony Rd, starting at 8 AM (Set-up at 7 AM). Talk-in on 147.15/146.79. Contact: *Charlie Apfelstadt N9GWS, TARS, P.O. Box 4521, Evansville IN 47724. Tel. (812) 477-7716.*

PRINCETON, IL The Starved Rock Radio Club Hamfest will be held at the Bureau County Fairgrounds, starting at 6 AM. Talk-in on 146.355/.955. For details, contact *Bruce Burton KU9A, or Debbie Burton N9DRU, 1153 Union St., Marseilles IL 61341-1710. Tel. (815) 795-2201.*

SALINA, KS The Central Kansas ARC will sponsor its annual Hamfest 8 AM-3 PM, in the 4H Bldg. in Kenwood Park. Flea Market. Commercial Booths. Contact *Larry White KB0BH, 336 Sunset Dr., Salina KS 67401. Tel. (913) 827-3737.*

SPECIAL EVENT STATIONS

APR 29-MAY 1

MOJAVE DESERT, CA Billy Holcomb Chapter of E Clampus Vitus will operate KC6LUC to commemorate Fort Cady. Operations will be in the phone portions of the General 80, 40, 20 and 15 meter subbands, and in the Novice 10 meter subband. For a certificate, send QSL and 9"x11" SASE to *KC6LUC, Sid Blumner, 1458 Albright Ave., Upland CA 91786-2722.*

APR 30

SONOMA VALLEY, CA The Valley of the Moon ARC, WB6DWY, will operate in commemoration of the City of Sonoma and the Valley of the Moon's rich historical heritage, from 1700 UTC-2400 UTC. The station will be operated during the club's annual Hamfest. Listen throughout the day on the General phone portions of 10, 20 and 40m. For a nice parchment certificate, QSL with SASE to *VOMARC, 358 Patten St., Sonoma CA 95476.*

APR 30-MAY 1

PHILADELPHIA, PA The Olympia ARC will operate WA3BAT from 1300Z April 30th-2000Z May 1st, to commemorate the 96th Anniversary of Admiral Dewey's triumph over the Spanish Fleet at the Battle of Manilla Bay. SSB/Phone—3.898, 7.268, 14.268, 21.368, 28.368, 145.270, and packet. For a certificate, send QSL and a 9"x12" SASE to *Olympia ARC, P.O. Box 928, Philadelphia PA 19105.*

MAY 1

WAMEGO, KS The Mahar ARC will operate KB0GPR 1400Z to 2000Z to celebrate the annual Mahar Family Reunion. Operation will be in the 20 and 40 meter General phone bands, 146.580 and 28.350. For a certificate, send QSL and business size SASE to *Mitch Anderson KB0GPR, P.O. Box 931, New Strawn KS 66839-0931.*

MAY 4-14

HOLLAND, MI The Holland ARC will operate a Special Event Station to celebrate Tulip Time. Operation will be in the lower portion of the General 20 and 15 meters and 28.400 MHz. For a certificate, send QSL with call signs worked, and a 9"x12" SASE to *N8NXA, Barbara Siebelink, 6418 Otis Rd., Saugatuck MI 49453.*

MAY 6-8

ABERDEEN WA The Grays Harbor ARC will operate W7ZA from 2300Z May 6th-2300Z May 8th, to celebrate their 40th Birthday. CW operation will be in the Novice portion of the 10, 15, 20, 40, and 80 meter subbands, as well as in the General portion of the 20 meter band. SSB will be in the General portion of the 10, 15, 20, 40, and 80 meter subbands and the 10 meter Novice band. For a QSL card, send QSL and SASE to *GHARC, P.O. Box 2250, Aberdeen WA 98520.*

MAY 7

DEKALB, IL The Kishwaukee ARC will operate WA9CJN 1600Z-2200Z to help celebrate the Three Fires Council BSA Scout-O-Rama show. The purpose is to encourage young men and boys to gain an interest in ham radio and earn the Radio Merit Badge. For a certificate, send an SASE to *KARC, WA9CJN, P.O. Box 264, Sycamore IL 60178, ATTN: KB9AGV.* Listen for WA9CJN on 28.430 +/- QRM.

MAY 9-14

VAN ALSTYNE, TX Amateur Astronomers/Hams representing the Southwest Region of the Astronomical League will be operating SE Station K5GH (K 5 Galaxy Hunters) at the 13th annual Texas Star Party. The TSP is located near the Univ. of Texas's McDonald Observatory in the Davis Mountains of West Texas. Operation will be (+/- QRM): 28365, 21365, 14265 and 7265. SSTV and CW contacts on request. For an astronomical theme QSL card, send QSL/SWL report and SASE to *K5GH-TSP, 2619 Bordeaux, McKinney TX 75070.*

MAY 10

PROMONTORY, UT The Ogden ARC will operate W7STB 0001Z-2100Z, to commemorate the driving of the Golden Spike at Promontory Summit. Frequencies: 3.970, 7.270, 14.280, 21.375, and 28.415 MHz. Send QSL and SASE to *Ogden ARC, P.O. Box 3353, Ogden UT 84409.*

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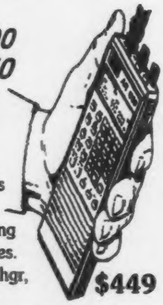

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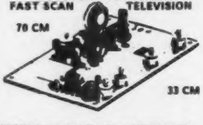

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MAY 13-15

SAN ANTONIO, TX The San Antonio RC will celebrate its Diamond Anniversary by operating W5SC from 2200Z May 13th-2200Z May 15th. Operation will be in the bottom 50 kHz of the General phone bands on 75-10 meters (Novice/Tech part of band on 10). For an 8 1/2"x11" certificate and QSL, send SASE and QSL to *"SARC Diamond Jubilee," 10227 Mt. Crosby, San Antonio TX 78251.*

MAY 14-15

BROKEN ARROW, OK The Broken Arrow ARC will operate AB5EE from 1500 UTC May 14-0300 UTC May 15 in conjunction with the Broken Arrow Chamber of Commerce sponsored "Rooster Day." Frequencies: 10m Novice band, along with all HF bands in CW and SSB. Also on VHF FM. For a certificate, send QSL and 9"x12" SASE to *Broken Arrow ARC, Box 552, Broken Arrow OK 74013.*

CARLISLE, PA The Cumberland ARC will operate K3IEC 1300Z-0100Z May 14th and 15th, to celebrate the Club's 30th Anniversary. Operation will be phone and CW on the 160-6 meter bands. For QSL, send QSL and SASE to *CARC, 107 Hilltop Rd., Boiling Springs PA 17007.*

MAY 15-JUNE 15

WAIANAE, HI To commemorate the beautification of Father Damien, Hawaiian hams will operate a variety of Special Event stations. Activities are planned for all bands, all modes, including the Novice subbands. Operations begin on May 15th, to coincide with the official ceremony in Belgium, and will continue until June 15th. For a QSL, please send your card, SASE, and name of operator worked to *AH6KY, Apt. #608, 84-265 Farrington Hwy., Waianae HI 96792; or directly to the operator contacted.*

MAY 20-22

HAINES FALLS, NY The Long Island Mobile ARC's Junior Operators Committee will operate K2YEW from their QRP Camping Weekend at North Lake State Park in Greene Co. Frequencies: 3.560, 7040, 14060. QSL to *Robert Todaro N2JIX, 2218 E. 73rd St., Brooklyn NY 11234.*

MAY 21

PASADENA, MD The Bay Area ARS, in cooperation with the Anne Arundell County Historical Soc., will operate Station KM3I to commemorate the 150th Anniversary of the telegraph message "What Hath God Wrought," transmitted on an experimental line from Washington DC to Baltimore MD. Operation will be 1300 UTC-2000 UTC on one or more of the following CW frequencies: 7.125, 14.125, 21.125, 21.225, 28.125 MHz. For a commemorative certificate, Amateurs send your QSL card; SWLs send details of the QSO, along with an 8 1/2"x11" SASE, to *Greg Ocfemia, Bay Area ARS, 419 Brooks Ct., Glen Burnie MD 21061.*

SEATTLE, WA The 2nd Annual NorthWest QRP Club Spring Sprint Contest will be held from 1700 UTC-2100 UTC. Frequencies: 7035-40, 14055-60, 21060 kHz. Logs must be received by June 15th, 1994 by: *Stan Yarema KG7ME, Contest Editor, 3457 12th West, Seattle WA 98119.*

MAY 21-22

HANSKA, MN The New Ulm ARC will operate KB0IWV 1600Z-0400Z May 21st, and 1600Z-2300Z May 22nd, to celebrate Hanska's 10th annual Syttende Mai. This is to commemorate the 180th Anniversary of the enactment of the Constitution of Norway. Frequencies: 7.250, 14.250 MHz, and the Club Rptr. at 147.33+. For a certificate, send a QSL and a 9"x12" SASE with 2 First Class stamps, or a #10 SASE (for a folded certificate) to *New Ulm ARC, KB0IWV - Patrick Mathiowetz, RR 4 Box 14-A, New Ulm MN 56073.* SWL reports welcome.

ST. CHARLES, MO The St. Charles ARC will operate WB0HSI 1300Z-2100Z as part of the Lewis and Clark Rendezvous, to commemorate the departure of the Lewis and Clark Expedition on 21 May 1804. Frequencies: 7.265, 14.265, 21.365, 28.465, 146.67, AO-13 Modes B and J, as propagation and QRM permit. For a certificate, send a 9"x12" SASE to *St. Charles ARC, P.O. Box 1429, St. Charles MO 6332-1429.*

MAY 21-23

OAK PARK, MI The Oak Park ARC will host the 1994 Michigan QSO Party, 1800Z May 21st-0300Z May 22nd; and from 1100Z May 22nd-0200Z May 23rd. Frequencies: CW-1810, 3540, 3725, 7035, 7125, 14035, 21035, 21125, 28035, 28125. Phone-1855, 3905, 7280, 14280, 21380, 28580. VHF-50.125, 145.025, 146.52. Results will be final on July 30th, 1994 and will be mailed to all entrants who have sent in an SASE. Mailing deadline is July 1st. Send logs to: *Mark Shaw K8ED, 27600 Franklin Rd., Apt. 516, Southfield MI 48034.*

MAY 28-29

BELLEVUE, NE The Bellevue ARC will operate W0WYV from the Strategic Air Command Museum, adjacent to Offutt Air Force Base, 1300Z-2200Z on May 28th and May 29th. Operation will be in the lower phone portion of the General 40, 20 and 15 meter bands, and if propagation permits, in the Novice portion of the 10 meter phone subband. For a QSL, send QSL card with contact number and a #10 SASE to *N4OWG, 1311 Greenwood Ave., Omaha NE 68133-2526.*

NORTH SYRACUSE, NY The Liverpool Amateur Rptr. Club will operate WA2ISC from 2000Z May 28th-2200Z May 29th, to commemorate the Mid-Empire State Chapter 293 Vietnam Veterans of America's WatchFire VII Memorial Day fire lighting. SSB operation will be in the vicinity of 7.240 and 14.240. CW operation will be in the lower 25 kHz of 40m and 20m general sub-bands. RTTY on 40m and 20m. Other bands as conditions permit. For a certificate, send QSL and 9"x12" SASE to *LARC, P.O. Box 103, North Syracuse NY 13212.*

MAY 30

ELGIN, IL Station W9IKN, sponsored by the Elgin ARS in conjunction with the annual running of the Valley Fox Trot 10-mile race, will be on the air from 1200Z-1700Z. Operation will be in the lower portion of the General subbands on SSB and CW, and propagation permitting, 50.200 SSB. For a certificate, send business size SASE to *E.A.R.S., P.O. Box 1351, Elgin IL 60123-1351.*

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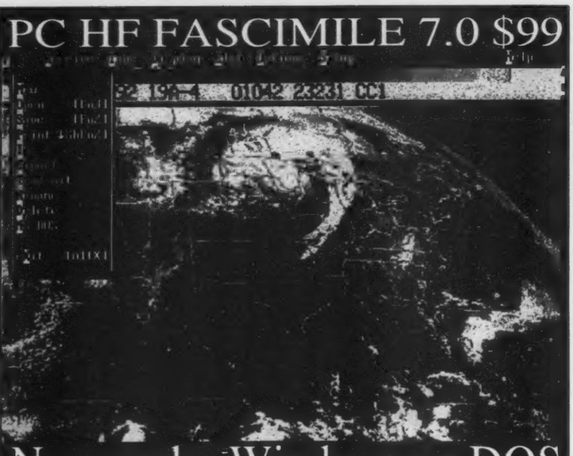

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Number 27 on your Feedback card

PROPAGATION

Jim Gray W1XU

Jim Gray W1XU
210 East Chateau Circle
Payson AZ 85541

This month's calendar shows few Good (G) days for propagation, while the remainder are Fair (F) to Poor (P) and trending from one to the other. DX success this month will require a good receiver and a lot of work. On the Good days you will find conditions favorable for DX, whereas on the Poor days you may hear few DX stations, and those are likely to be on the north-south path across the equator. The Fair days are the ones where opportunity will present itself but will require effort, with signals fading in and out and general instability on all bands. As usual, when conditions are marginal, the higher HF bands tend to be affected the most. Anticipated conditions by band are as follows:

10-12 Meters

Some north-south openings during afternoon hours. On some days you will find sporadic E that can provide signal paths of short duration to 1,000 miles or so.

15-17 Meters

On good days you will have fairly good openings to the southern hemisphere during daylight hours, peaking in the afternoon. There will be occasional openings to Europe and Africa on east-west paths, also during the local afternoon. There will be plenty of short-skip and sporadic E skip on many days, out to 1,000-1,500 miles.

20 Meters

The best band for worldwide propagation during daylight hours. This band ought to open shortly after sunrise and remain open until after dark. Peak conditions should occur an hour or two after sunrise and again in the late afternoon. Short-skip will be favorable during the daylight hours beyond about 500 miles.

30-40 Meters

Evening, nighttime and sunrise hours are best on these bands for DX contacts. From sunset to midnight toward Europe and Africa, and generally toward the East. During sunrise and for a half hour or so on either side, look for DX to the West and Pacific areas. Daytime short skip to about 1,000 miles, and nighttime skip out to 2,000 miles will occur. Increasing static levels will be present, and may sometimes prevent hearing all but the strongest signals on these bands.

80-160 Meters

No DX openings during daylight hours on these bands. After dark on some days you may find DX (limited by QRN), and again around sunrise. Short skip of 200 miles or so may be available on 80 meters, and distances out to 2,000 miles or so at night. On 160 meters, skip out to about 1,000 miles should be available when QRN is absent.

Special Conditions

There may be some severe weather or other geophysical disturbances surrounding the dates of May 16th and 27th, and lasting for a day or two. Keep your ear open for WWV on 5, 10, 15, and 20 MHz at 18 minutes after each hour for latest propagation news.

There will be a partial lunar eclipse on May 25th, visible in most of both hemispheres. 73

EASTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA							20	20				
AGENTINA	20	20						15	15	15	15	15
AUSTRALIA						40	20	20			15	15
CANAL ZONE	20	40	40	40	40		20	15	15	15	15	20
ENGLAND	40	40	40				20	20	20	20		
HAWAII		20			40	40	20	20				15
INDIA							20	20				
JAPAN							20	20				
MEXICO		40	40	40	40		20	15	15	15	15	
PHILIPPINES							20	20				
PUERTO RICO		40	40	40	40		20	15	15	15	15	
SOUTH AFRICA									15	15	15	
U.S.S.R.							20	20				
WESTCOAST			80	80	40	40	40	20	20	20		

CENTRAL UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	20	20						15				
ARGENTINA										15	15	15
AUSTRALIA	15	20				40	20	20				15
CANAL ZONE	20	20	20	40	40	40			15	15	15	20
ENGLAND		40	40					20	20	20	20	
HAWAII	15	20	20	20	40	40	40					15
INDIA								20	20			
JAPAN								20	20			
MEXICO	20	20	40	40	40	40			15	15	15	20
PHILIPPINES								20	20			
PUERTO RICO	20	20	40	40	40	40			15	15	15	20
SOUTH AFRICA										15	15	20
U.S.S.R.								20	20			

WESTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	20	20	20		40	40	40	40				15
ARGENTINA	15	20		40	40	40					15	15
AUSTRALIA		15	20	20			40	40				
CANAL ZONE			20	20	20	20	20	20				15
ENGLAND									20	20		
HAWAII	15	20	20	40	40	40	40					15
INDIA		20	20									
JAPAN	20	20	20			40	40	40			20	20
MEXICO			20	20	20	20	20	20				15
PHILIPPINES	15							40		20		
PUERTO RICO			20	20	20	20	20	20				15
SOUTH AFRICA										15	15	
U.S.S.R.									20			
EAST COAST		80	80	40	40	40	40	20	20	20		

MAY 1994

SUN	MON	TUE	WED	THU	FRI	SAT
1 P-F	2 F-G	3 G-F	4 F	5 F-G	6 G	7 G-F
8 F	9 F-G	10 G	11 G	12 G	13 G-F	14 F-P
15 F-P	16 F-P	17 F-P	18 P	19 P	20 P	21 P
22 P-F	23 F-G	24 G	25 G-F	26 F-P	27 P	28 P
29 P-F	30 F	31 F-G				

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Make your list, count the words, including your call, address and phone number. Include a check or your credit card number and expiration. If you're placing a commercial ad, include an additional phone number, separate from your ad.

This is a monthly magazine, not a daily newspaper, so figure a couple months before the action starts; then be prepared. If you get too many calls, you priced it low. If you don't get many calls, too high.

So get busy. Blow the dust off, check everything out, make sure it still works right and maybe you can help make a ham sure it still works right and maybe you can help make a ham newcomer or retired old timer happy with that rig you're not using now. Or you might get busy on your computer and put together a list of small gear/parts to send to those interested?

Send your ads and payment to the Barter 'n' Buy, Judy Walker, 70 Rt. 202N, Peterborough NH 03458 and get set for the phone calls.

The deadline for the June classified ad section is April 7, 1994.

ALL ABOUT CRYSTAL SETS. Theory and construction of crystal set radios. $7.95 each, ppd USA. Send to: **ALLABOUT BOOKS**, Dept. S, P.O. Box 22366, San Diego CA 92192. BNB200

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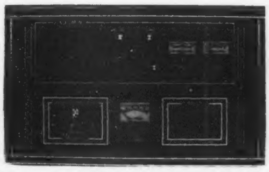

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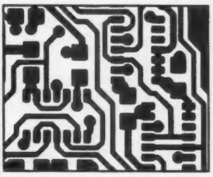

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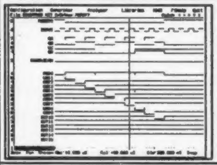

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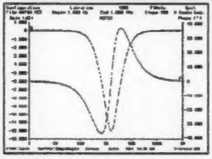

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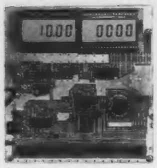

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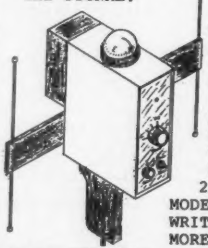

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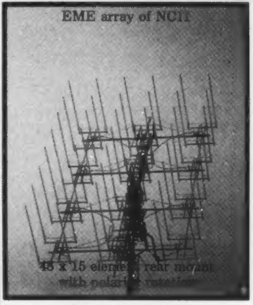

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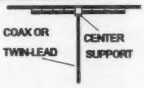

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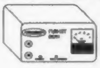

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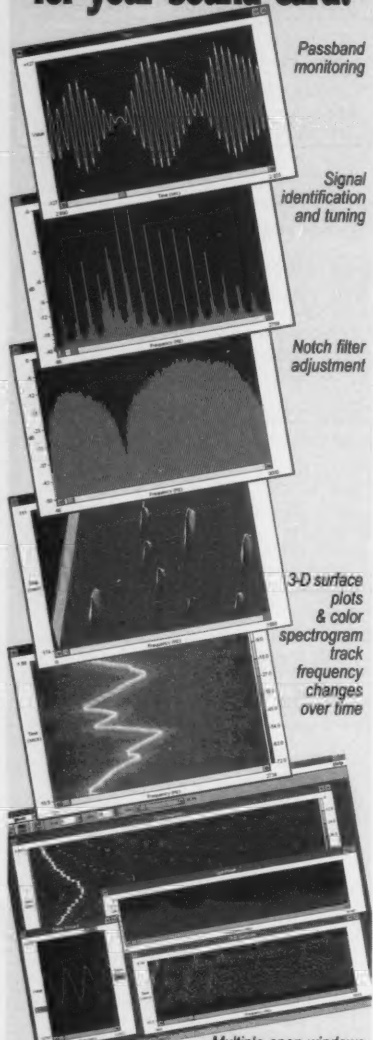

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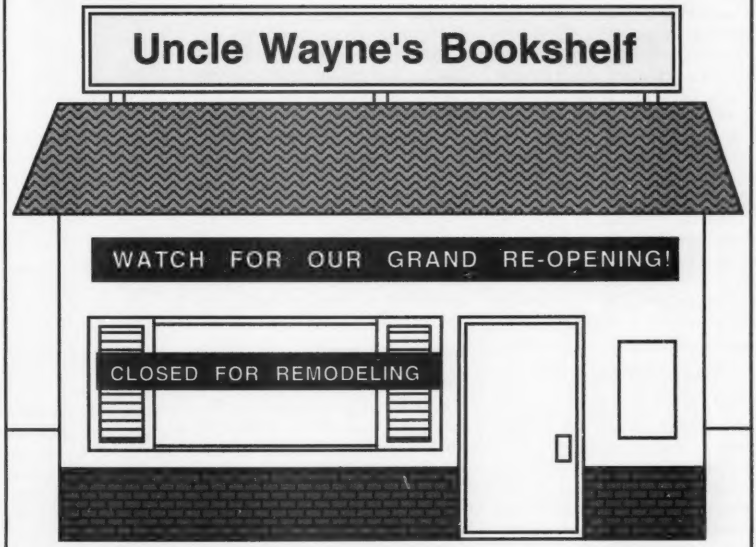

We're making some changes at Uncle Wayne's Bookshelf, changes that will enable us to offer you the books you want at prices you like.

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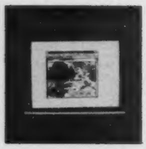
NEW PRODUCTS

Compiled by Charles Warrington WA1RZW

AEA



Advanced Electronic Applications, Inc. is proud to introduce AEA WeFax 256—a new software accessory for users of their DSP-2232/1232 multimode controllers. AEA WeFax 256 is a Windows program for reception and display of gray scale WeFax images.

AEA WeFax 256 displays, in real time, true gray scale images from either the NOAA HF WeFax Service or the NOAA APT Satellite Service. It will provide two modes of resolution—500 or 250 pixels per line—which ensures that the AEA WeFax 256 imaging system will work on your setup. This product incorporates a scrollable receive buffer capable of operating in stop or loop modes.

AEA WeFax 256 comes complete with an image processor. It will support BMP, GIF, PCX, TIF, and JPG image formats. It integrates an Auto Clock function to "wake up" your system; and captures unattended transmissions.

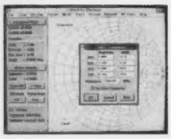
The suggested retail price for the AEA WeFax 256 is $129. AEA WeFax is available from your favorite amateur radio dealer. For more information, please contact *Advanced Electronic Applications, Inc., P.O. Box C2160, Lynnwood, WA 98036; (206) 774-5554; FAX (206) 775-2340.* Or circle Reader Service No. 201.

NUMBER ONE SYSTEMS LTD.

The paper Smith chart, invented over 50 years ago, provides a graphical method for solving impedance matching and transmission line problems. Now, Number One Systems' new Z-MATCH for Windows program greatly enhances the usefulness and accuracy of Smith chart techniques, and adds a wide range of valuable Radio Frequency Engineering utilities.

Z-MATCH for Windows provides RF and Communications designers with a comprehensive set of circuit and system design tools in a remarkably easy-to-use, low-cost package. An immediately apparent advantage of Z-MATCH for Windows is that it works directly with actual lengths of transmission line and actual resistance and reactance values, eliminating the need for normalization. The designer can also switch instantly between impedance and admittance charts.

Z-MATCH for Windows also provides a receiver and system design tool for calculating overall values of gain, noise figure and more. For RF amplifier designers, Z-MATCH for Windows' ability to work directly with S-Parameters greatly simplifies many design tasks. Options include plotting stability circles, the calculation of stability factor, transducer gain, maximum available gain and the source and load impedances needed to achieve it, and even the determination of the component values to provide source and load matches for specified Q.



The program comes complete with a comprehensive instruction manual covering both the theory and practice of using Smith chart techniques and includes many case examples. Z-MATCH for Windows requires a minimum of an AT286 running Microsoft Windows 3.0 or later, and is available direct. The price is $375. For more information contact *Number One Systems Ltd., Harding Way, St. Ives Huntingdon, Cambs. PE17 4WR England; +44 480 461778; FAX +44 480 494042.* Or circle reader Service No. 204.

B+K PRECISION

B+K's new high current variable 3-14 VDC power supply is designed expressly as a substitute for an auto or truck battery. Model 1688 produces nominally 25A maximum at 13.8 VDC continuously, hour after hour, without overheating. (Maximum current output is lower at lower voltages).

Model 1688 is ideal for servicing or demonstrating mobile electronics equipment, such as ham radios. It is a preferred substitute for heavy vehicle batteries that leak acid, must be recharged, and cannot tolerate shorted loads; and for typical high-current DC power supplies that are either high priced or designed for intermittent duty only.

Voltage can be varied from 3 to 14 VDC. Current and voltage can be monitored simultaneously on separate analog meters. Outputs are fully isolated. Line and load regulation are tight (+ or - 0.8%) and ripple is low (less than 10mVrms). Two or more supplies can be connected in series or parallel to double the voltage or current output. And to withstand accidental abuse, Model 1688 has reverse polarity protection, overload protection, short circuit protection, thermal protection, and current limiting.

Model 1688 is priced at $299. For more information or for the name of your nearest distributor, contact *B+K Precision, 6470 W. Cortland St., Chicago, IL 60635; (312) 889-1448.* Or circle Reader Service No. 206.

S-COM INDUSTRIES

S-COM Industries is now shipping a powerful new software upgrade with all 6K Repeater Controllers, which includes a 100-setpoint scheduler to execute tasks at programmed times and dates. Uses include changing the repeater's access mode based on day and night; generating special identifier messages for holidays or special events; announcing nets; charging batteries; weekly pager tests; and so on.

The 6K Repeater Controller with Autopatch is priced at $395. Older 6K controllers may be upgraded with a 6K V2.0 Kit for $49.95 plus $3 for shipping and handling.

For more information, contact *S-COM Industries, P.O. Box 1718, Loveland, CO 80539-1718; (303) 663-6000.* Or circle Reader Service No. 202.

TECHSONIC

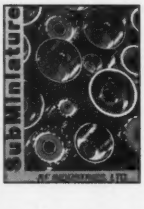
A new line of attractive, sturdy QRP transmitter kits is now available for 20, 30, and 40 meters from TechSonic. These professionally engineered 3-watt rigs feature low current drain for long battery life and clean, chirp-free DC keying with low harmonic content.

Output levels on these rigs are adjustable from under 100 mW to 3 watts by changing input voltage; i.e. a 9-volt transistor battery will run all weekend and provide one-half watt out. Twelve volts gets you one watt out, and 16 to 18 VDC delivers 3 watts. The output transistor is fully SWR protected. An RX antenna jack couples to your receiver for single-antenna convenience and full QSK.

Frequency control is via VXO and provides 7 to 14 kHz coverage depending on the band. A QRP frequency crystal is included with each unit. Kits come complete with PC board, all components, connectors, and thorough instructions for easy assembly. All coils are pre-wound. Information on QRP operating, clubs, and awards is also included.

For more information contact *TechSonic, 1642 Butler Pike Suite 127C, Conshohocken, PA 19428; (610) 834-1978.* Or circle Reader Service No. 203.

RF INDUSTRIES



RF Industries' new 28-page catalog presents an expanded range of SMA connectors. These connectors are designed to offer reliable broadband performance from DC to 18 GHz at a consistent 50 ohm impedance. They feature high mechanical strength, high durability and low VSWR.

The SMA series (RSA-3xxx) will encompass connectors for flexible cable as well as semi-rigid cable. It will also include in-series adapters and between-series adapters.

For your free copy, call or write *RF Industries, Ltd., 7620 Miramar Road, San Diego, CA 92126-4202; (619) 549-6340; FAX (619) 549-6345.* Or circle Reader Service No. 205.

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The new 1994 catalog from Contact East is 244 pages of new test instruments and tools for engineers, managers, technicians, and hobbyists. Featured are quality products from brand-name manufacturers for testing, repairing, and assembling electronic equipment. Product highlights include new: DMMs and accessories, soldering tools, custom tool kits, EPROM programmers, power supplies, ELF meters, helpful reference books, breadboards, scopes, meters, datacom tools and testers, adhesives, measuring tools, precision hand tools, and portable and bench top digital storage scopes.

Also included are Contact East's popular lines of communication test equipment, soldering/desoldering systems, static protection products, ozone safe cleaners, magnifiers, inspection equipment, workbenches, cases and more. All products are fully guaranteed, and orders placed by 4 p.m. are shipped by 5 p.m. To receive your free copy, call or write *Contact East, 335 Willow Street, No. Andover, MA 01845; (508) 682-2000; FAX (508) 688-7829.* Or circle Reader Service No. 207.

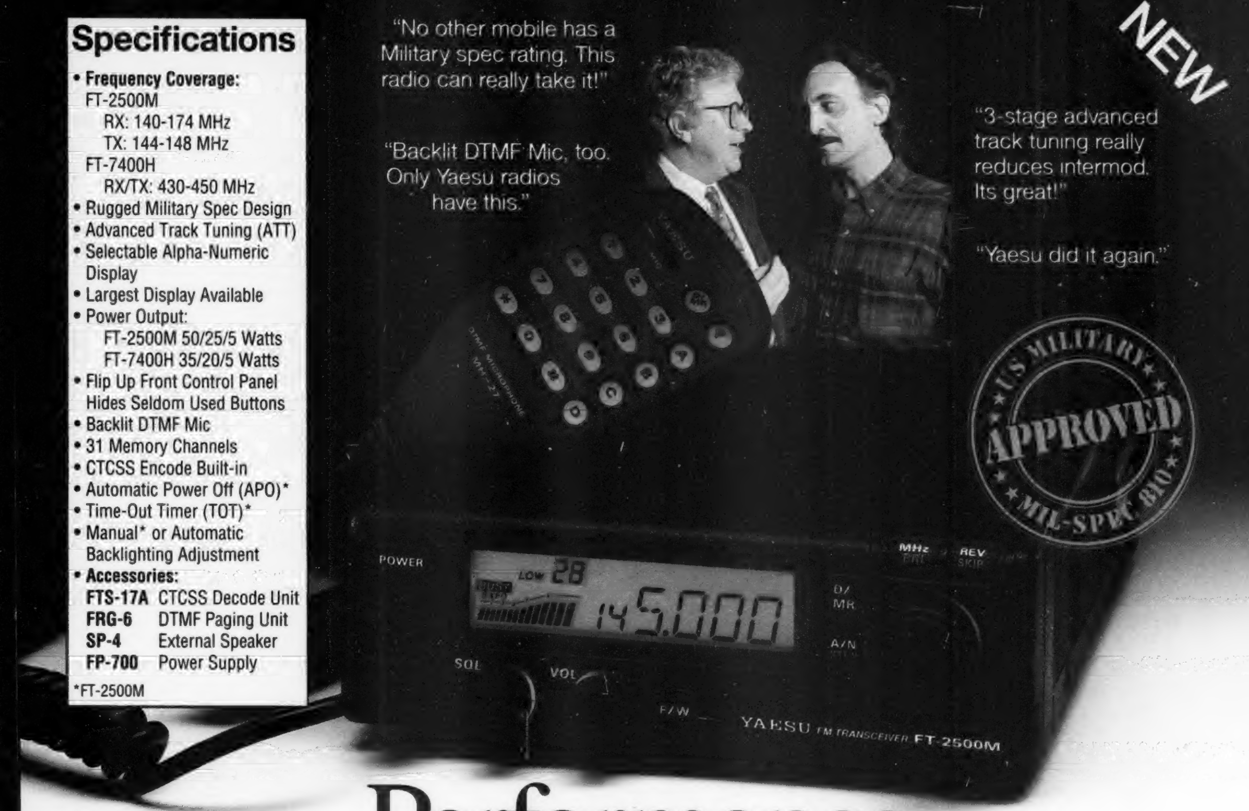
FT-2500M/FT-7400H 2m/70cm Mobiles

Specifications

- **Frequency Coverage:**
  FT-2500M
  RX: 140-174 MHz
  TX: 144-148 MHz
  FT-7400H
  RX/TX: 430-450 MHz
- Rugged Military Spec Design
- Advanced Track Tuning (ATT)
- Selectable Alpha-Numeric Display
- Largest Display Available
- Power Output:
  FT-2500M 50/25/5 Watts
  FT-7400H 35/20/5 Watts
- Flip Up Front Control Panel Hides Seldom Used Buttons
- Backlit DTMF Mic
- 31 Memory Channels
- CTCSS Encode Built-in
- Automatic Power Off (APO)*
- Time-Out Timer (TOT)*
- Manual* or Automatic Backlighting Adjustment
- **Accessories:**

FTS-17A	CTCSS Decode Unit
FRG-6	DTMF Paging Unit
SP-4	External Speaker
FP-700	Power Supply

*FT-2500M



"No other mobile has a Military spec rating. This radio can really take it!"

"Backlit DTMF Mic, too. Only Yaesu radios have this."

"3-stage advanced track tuning really reduces intermod. Its great!"

"Yaesu did it again."

Performance beyond the call of duty.

Just when you thought you had the most formidable mobile built, we made the FT-2500M. It's the next evolution of powerful, rugged mobile radios.

The FT-2500M, based on the acceptance of the popular FT-2400H, takes its durable quality, features, and performance then goes one better! The FT-2500M has a new easy-to-operate front panel design with rubber coated knobs and large amber display, and the Yaesu exclusive 3-Stage Advance Track Tuning feature which reduces intermodulation and front-end overload. With its superior technology, the FT-2500M is as close as you can get to commercial grade performance in amateur frequencies.

The FT-2500M is the only mobile with a Military spec rating; the only mobile radio with the most often used controls on the front and those you "set and forget" neatly hidden; and the only mobile radio with a backlit DTMF mic. With its extra large heat sink and one-piece die-cast chassis, the tough FT-2500M is unlike any other mobile in its class.

So test the mettle of your mobile, if it doesn't measure up to the endurance standards set by the U.S. Military, you need the FT-2500M. Designed for flawless performance in rough and rugged situations, the FT-2500M is really formidable – just what you'd expect from Yaesu. See it at your dealer today!

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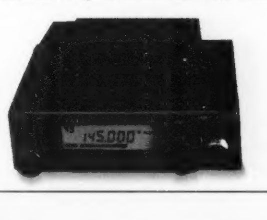
FT-2200/7200

Just 5.5"W x 1.6"H x 6.5"D, the FT-2200/7200 radios are designed to fit into today's more compact cars with ease.

SPECIFICATIONS • Frequency Coverage: FT-2200 RX: 110-180 MHz, TX: 144-148 MHz. FT-7200 RX/TX: 430-450 MHz. • Wide Receiver Coverage: 110-180 MHz • AM "Aircraft" Receive: 110-139 MHz • Built-in DTMF Paging/Coded Squelch • Selectable Channel Only Display • 10 Memory DTMF Auto Dialer • Backlit DTMF Mic • Power Output 50/25/5 Watts (FT-7200 35 Watts) • 50 Memory Channels • Remote Operation w/ Optional MW-2 • CTCSS Encode Built-in • Optional Digital Voice Storage System. Accessories: See your authorized Yaesu dealer.



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Specifications subject to change without notice. Specifications guaranteed only within amateur bands. Some accessories and/or options are standard in certain areas. Check with your local Yaesu dealer for specific details.

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40
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Features

- Max. 50W output (144MHz), 35W (440MHz)
- "6-in-1" programmable memory
- 72 memory channels
- Time-Operated & Carrier-Operated scan stop modes
- Dual receive on same band (VHF+VHF or UHF+UHF)
- Built-in DTSS selective calling with page
- ASC (Auto Simplex Checker)
- Built-in CTCSS encoder & optional TSU-8 decoder
- Key function display
- Automatic band change
- AIP (Advanced Intercept Point)
- Cross-band repeater
- Selectable frequency step (5, 10, 12.5, 15, 20 or 25kHz)
- Wireless clone function
- Incremental MHz key
- S-meter squelch
- Tone alert system with elapsed time indicator
- Separate speaker terminals for each band (switchable)
- Auto repeater offset (144MHz)
- Repeater reverse switch & offset switch
- 3-position RF output power control
- Dimmer control
- Auto power-off

*This device has not been approved by the Federal Communications Commission. This device is not, and may not be offered for sale or lease, or sold or leased until the approval of the FCC has been obtained.

*An optional accessory kit is required to mount the front panel separately from the main unit.

TM-733A

FM DUAL BANDER

1200*
9600

Kenwood's new FM dual bander, the TM-733A (144MHz/440MHz), is specially tailored for hassle-free mobile communications with a unique "6-in-1" programmable memory. Six entire operating profiles—including everything from frequency range to dimmer level—can be stored, ready for instant recall. So there's virtually no need to adjust your settings. The detachable front panel has a high-visibility LCD with key function display to make on-the-move operation even easier. Of course, this compact transceiver has a full complement of sophisticated features, including 72 memory channels, DTSS selective calling and page functions, ASC (checks whether you can switch from a repeater to simplex communications), AIP (Kenwood's exclusive circuit for enhancing RX performance), and a jack for 1200/9600bps packet use. And as well as receiving simultaneously on VHF and UHF bands, the TM-733A can receive two frequencies on the same band (VHF+VHF or UHF+UHF). There's even an optional quick-release kit as an added anti-theft measure. So check out the TM-733A—a sensation bred from inspiration.

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AMATEUR RADIO PRODUCTS GROUP
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